WAVETEK

SERVICE MANUAL

Models 2010, 2020, 2030
Digital Multimeters

For Operation Information on the Series 2000 multimeters, refer to separate Operator's Manual, P/N 1000-0455-01B.

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Section I Introduction

The Wavetek Series 2000 autoranging digital multimeters measure the electrical functions of voltage, current, resistance, and tests continuity and diode junctions. Front panel push buttons provide the operator with the ability to select the desired meter special features; Range Lock, Probe Hold™, Relative Mode, or Auto Min Max™ Mode.

The meter operates on one of two modes: Range Lock or autoranging. Range Lock allows the function range to be set to a specified range. The autoranging feature provides fast automatic adjustment to the appropriate measurement range, allowing easy hands-off operation. For further information, refer to the Series 2000 Operator's Manual.

Other unique features to the Series 2000 multimeters include:

Auto-Power Down (Battery Saver)	Protective Holster
Dangerous Voltage Indication	Overload Alert™

The meter features a compact design for easy handling. It is constructed of a tough, internally braced case with rounded corners and edges.

Specifications

This section provides physical, mechanical, and environmental specifications for the Wavetek 2010, 2020, and 2030 multimeters. Specifications are subject to change without notice.

General Specifications

Display:	LCD, quadriplex, 19999 count; annunciators, menu features and bar graph.
Update:	Digits, 2/second Bar graph, 20/second
Battery:	9 volt, Alkaline; NEDA 1604 A
Battery Drain:	2.2mA typical (DCV, no input)
Battery Life:	200 hours typical (alkaline)
Power Off Mode:	< 10μA
Low Battery Indicator:	Battery voltage < = 7.5V; 20 hours left
Low battery CUT-OFF:	Battery voltage < = 6.6V
Maximum Common Mode Voltage:	1000 VDC or Peak AC

Physical (Not including holster)

Height:	175mm (7.5 in.)
Width:	90mm (3.5 in.)
Depth:	34mm (1.30 in.)
Weight:	568g (20 oz.)

Mechanical

Shock and Vibration:	MIL-T-28800, class II
Case Material:	Flame retardant, high-impact thermoplastic

Environmental

Operating Temperature:	0° to 50° C
Relative Humidity:	0 to 80%
Storage Temperature:	-40° to 70° C
Relative Humidity:	0 to 95% (battery removed)
Temperature Coefficient:	<0.1 x (specified accuracy) per degree C (0° to 20° C, 30° to 55° C)

Safety

Designed to UL1244, IEC348, IEC1010,
CSA 22.2 No.231

Calibration

Accuracy specifications guaranteed for one year.

Transient Protection	AC/DC Voltage Ranges: 6kV (V-Ω input jacks shunted by 250pF capacitor. 1.2 x 50μs per IEEE-587, CAT-B.

Start Up Sequence

A. The meter will first show all segments of the LCD ON. This can be extended by pressing the Second Function button.
B. Battery cutoff test: "bAtt" will show in the display. The bar graph points at the approximate positive power supply voltage. Nominal cutoff point for the positive power supply voltage is 5.25 on the scale. If power supply voltage is lower than 5.25, meter will indicate "lobt" (Low Battery) and shut itself off.
C. The unit will now go to the appropriate display for the function selected.

Display Update Rate

Numerals: Numerals: 2/second
Bar Graph: Bar Graph: 20/second

DC VOLTS

Ranges	Resolution	Accuracy (% rdg ± digit) 2010, 2020	2030
100.00mV	0.01mV	0.25% ± 2	0.10% ± 2
1000.0mV	0.1mV	0.25% ± 2	0.10% ± 2
10.000V	1.0mV	0.25% ± 2	0.10% ± 2
100.00V	10mV	0.25% ± 2	0.10% ± 2
1000.0V	100mV	0.25% ± 2	0.10% ± 2

Response: < 2 sec, manual or autoranging
Input impedance: 10 Meg ohms
Display Bar Graph: Indicates percent of range
Normal Mode Rejection Ratio: > 60dB at 50 and 60Hz
Common Mode Rejection Ratio: > 120dB up to 1000VDC (< = 1k unbalance).
Overload Protection: 1000VDC
Overload Indication: "OL" indicates a range overload. In the 1000V range, and the input > 1020.9VDC, there is also a continuous warning tone.
Lethal Voltage Indication: Lightning bolt in LCD and double beep when the input exceeds 25V.

AC VOLTS

Input is from 5% to full-scale on each range

Ranges	Resolution	Frequency	Accuracy (% rdg ± digit), Crest Factor < 1.5)
100.00mV	0.01mV	45 to 400Hz	2.0% ± 8 digit
1000.0mV	0.1mV	45 to 2kHz	2.0% ± 8 digit
10.000V	1.0mV	45 to 2kHz	2.0% ± 8 digit
100.00V	10.0mV	45 to 2kHz	2.0% ± 8 digit
1000.0V	100mV	45 to 2kHz	2.0% ± 8 digit

Response: < 3 sec Manual or autoranging
Frequency Response: 3dB > 10kHz
Input Impedance: 10 Meg ohms shunted by < 100pF
Display Bar Graph: Indicates percent of range
Conversion Type: 2020, 2030; True RMS AC coupled and Average Responding, 2010; Average Responding
Crest Factor for True RMS (peak/RMS ratio): 1:1 through 5:1
Overload Protection: <10Hz, 400VRMS; >10Hz, 1000VRMS
Overload Indication: "OL" indicates a range overload. In the 1000V range, and the input > 1020.9VAC, there is also a continuous warning tone.

DC CURRENT

Range	Resolution	Accuracy (% rdg ± digit) 2010,2020	2030	Voltage Burden
1000.0µA	0.1µA	1.0% + 2	0.50% ± 2	15mV/mA
10.000mA	0.001mA	0.5% + 1	0.35% ± 1	15mV/mA
100.00mA	0.01mA	0.5% + 1	0.35% ± 1	15mV/mA
1000.0mA	.01mA	1.0% + 2	0.50% ± 1	40mV/A
10.000A	1.0mA	1.0% + 1	1.00% ± 1	40mV/A
20.00A	10mA	1.0% + 1	1.00% ± 1	40mV/A

Response:	< 3 sec manual or autoranging	
Display Bar Graph:	Indicates percent of range	
Overload Protection:	mA	.25A, 600V fuse; 1000A Interrupt Rating
	A	15A/600V fuse; 100,000A Interrupt Rating
Amps Capability:	10A	continuous
	20A	for 30 seconds
Over-Range Indication:	"OL"	Input > 102.09mA has a continuous tone
		Input > 20.49A has a continuous tone

AC CURRENT

Input is from 5% to full-scale on each range.

Range	Resolution	Frequency	Accuracy (Crest Factor <= 1.5)	Voltage Burden
1000.0µA	0.1µA	45Hz - 1kHz	1.7%±8 digits	15mV/mA
10.000mA	0.001mA	45Hz - 1kHz	1.7%±8 digits	15mV/mA
100.00mA	0.01mA	45Hz - 1kHz	1.7%±5 digits	15mV/mA
1000.0mA	0.1mA	45Hz - 1kHz	1.7%±5 digits	40mV/A
10.000A	1.0mA	45Hz - 1kHz	1.7%±3 digits	40mV/A
20.00A	10mA	45Hz - 1kHz	1.7%±3 digits	40mV/A

Response:	< 3 sec manual or autoranging	
Frequency Response:	3dB > 10kHz	
Conversion Type:	True RMS AC coupled (2020, 2030);	
	Average Responding (2010)	
Crest Factor:		
(Peak/RMS Ratio)	1:1 through 5:1	
Display Bar Graph:	Indicates percent of range	
Overload Protection:	mA	.25A, 600V fuse; 1000A Interrupt Rating
	A	15A/600V fuse; 100,000A Interrupt Rating
Amps Capability:	10A	continuous
	20A	for 30 seconds
Over-Range Indication:	"OL"	Input > 102.09mA has a continuous tone
		Input > 20.49A has a continuous tone

RESISTANCE

Range	Resolution ohms	Accuracy (% rdg ± digit) 2010, 2020	2030	Test Current (Max)	Test Voltage (Max)
100.00	0.01	0.7%±4 digits	0.5% ± 4	1.0mA	100mV
1000.0	0.1	0.5%±4 digits	0.3% ± 4	0.1mA	100mV
10.000k	1.0	0.5%±4 digits	0.3% ± 4	10µA	100mV
100.00k	10	0.5%±4 digits	0.3% ± 4	1.0µA	100mV
1000.0k	100	0.5%±4 digits	0.3% ± 4	0.1µA	100mV
10.000M	1.0k	1.5%±4 digits	0.7% ± 4	0.1µA	1.0V
20.00M	10k	2.0%±4 digits	1.2% ± 4	0.1µA	2.0V

Response:	< 2 sec below 1 Meg <3 sec above 1 Meg manual or autoranging
Display Bar Graph:	Indicates percent of range up to 10MΩ
Maximum Open Circuit Voltage:	6.5V
Over-Range Indication:	"OPEN" in display when in autorange mode "OL" in display when in range lock mode
Overload Protection:	500VRMS

PULSE DETECTOR

Indication:	Positive transitions detected emits a tone
Tone Length:	Approximately 50mS. If transition >20Hz rate, tone is continuous.
Detector:	AC coupled
Logic Levels:	TTL, CMOS
Threshold:	2.6 volts
Input Impedance:	10MΩ shunted by 150pF
Display Bar Graph:	Indicates percent of range (for DC volts)
Pulse Width (min):	50nS
Pulse Rise Time (max):	10nS
Pulse Rep Rate (max):	1MPPS

DIODE/CONTINUITY

Range	Resolution	Accuracy (% rdg ± digit)	Short Circuit Current (Max.)	Open Circuit Voltage (Max.)
2.0000V	0.2mV	1.0%±5 digits	1.0mA	5.5V

Display Response:	< 2 second
Continuity Response Time:	< 50mSec
Continuity Threshold:	< 200 millivolts
Display Bar Graph:	Indicates percent of range to one volt only
Continuity Indication:	Continuous tone
Open Circuit Indication:	"OPEN" in display
Overload Protection:	500VRMS

"W" The Diode/Continuity range is not to be used to measure explosive bolts or squibs.

CAPACITANCE

Range	Resolution	Accuracy (% rdg ± digit)
20.0nF	100pF	2.0% ± 3 digits
200nF	1nF	2.0% ± 3 digits
2.00µF	0.01µF	2.0% ± 2 digits
20.0µF	0.1µF	2.0% ± 2 digits
200µF	1µF	3.0% ± 3 digits
2.00mF	10µF	3.0% ± 8 digits

Response: After the first update
< 1 sec below 20µF
< 2 sec below 200µF
< 25 sec to 2mF

Manual or Autoranging

Maximum Open Circuit Voltage: 6.5V

Over-Range Indication:
"OL" in display in autorange for a capacitor too large or the leads are shorted together.
"OL" in display in range lock for a capacitor too large for the range or the leads are shorted together.
"OPEN" in display in range lock for a capacitor that is less than ten percent of the full-scale range (except the 20nF range, which shows to zero).

Overload Protection: 500VRMS

FREQUENCY

Range	Resolution	Accuracy (% rdg ± digit)	Sensitivity
19.999kHz	1.0Hz	0.1% ± 2 digits	100mV
199.99kHz	10Hz	0.1% ± 2 digits	100mV
1.9999MHz	100Hz	0.1% ± 2 digits	1.0V

Response: <1.5 sec
Input Impedance: 51kΩ into diodes, AC Coupled
Display Bar Graph: Not present
Overload Protection: 300VRMS

SECOND FUNCTIONS (2nd function button)

TRMS

True RMS: DC and AC volts
Specification: Same as AC volts (including frequency range)
DC volts: 2.0% on all ranges. If a high DC voltage is present, the unit will have to be in range lock to get the correct reading.
Response: < 3 sec manual or autoranging
Input impedance: 10 Meg ohms shunted by < 100 pF
Display Bar Graph: Indicates percent of range (AC component only).
Conversion Type: True RMS
Crest Factor (peak/RMS ratio): 1:1 through 5:1
Overload Protection: 1000 VRMS
Overload Indication: "OL" indicates a range overload. In the 1000V range, and the input > 1020.9VDC, there is also a continuous warning tone.
Lethal Voltage Indication: Lightning bolt in LCD and double beep when the AC input exceeds 25VRMS

True RMS also works in DC amps, becoming DC and AC amps. The specifications are the same as AC amps.

Peak Hold Accuracy: Model 2020: 5% of Range; Model 2030: 1.5% of Range.

DUTY CYCLE

Frequency Ranges	Percent Range	Resolution	Accuracy (% rdg ± digit)
40 to 1000Hz	5 to 95%	0.1%	2.0% ± 1 digit
1k to 20kHz	5 to 95%	0.1%	1.0% ± 1 digit
20 to 100kHz	15 to 85%	0.1%	5.0% ± 1 digit

Response: <1.5 sec
Input Impedance: 51k into diodes, AC Coupled
Display Bar Graph: Not present
Overload Protection: 300VRMS

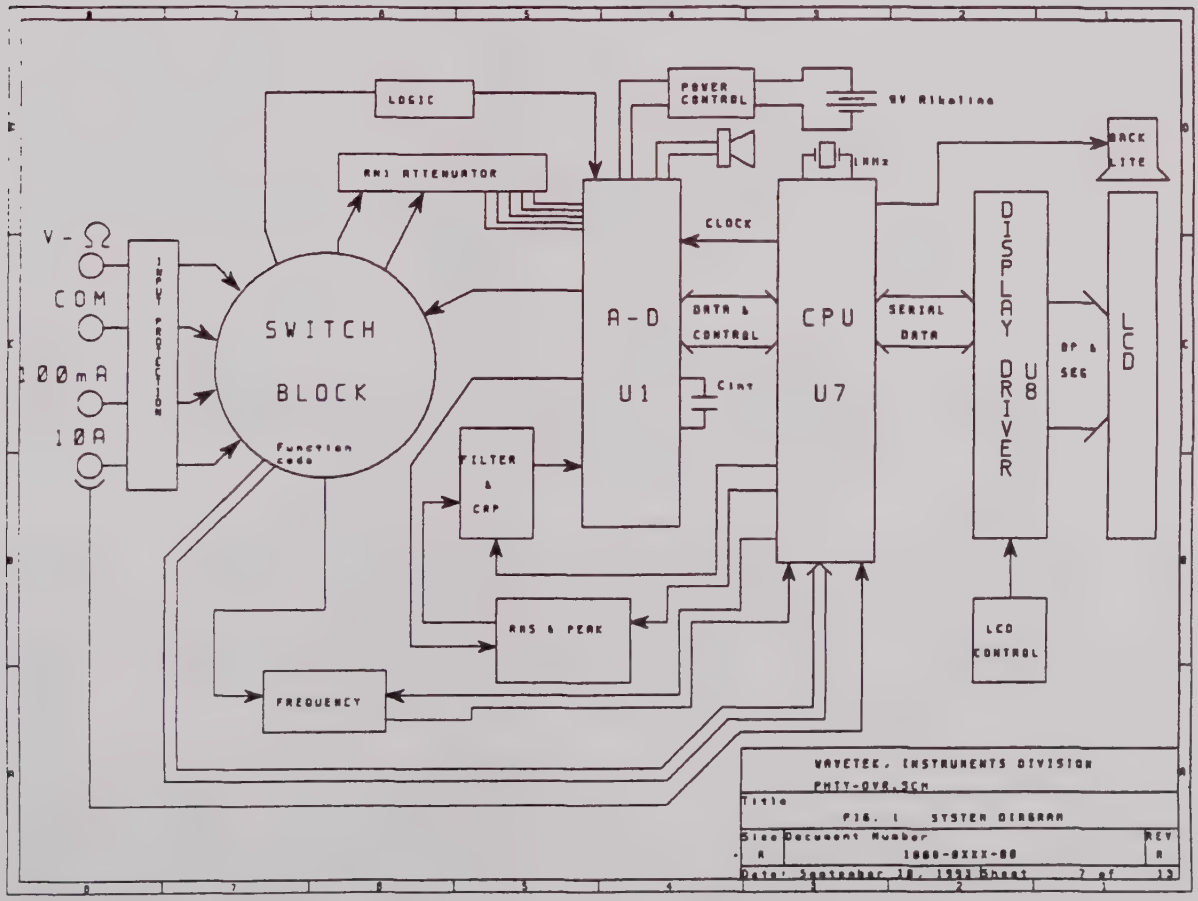
The Series 2000 digital multimeters are constructed of a two-piece protective case, two circuit boards, LCD display, front panel rotary switch, and push buttons. The two circuit boards, Input and Display boards (the Display Board is the smaller of the two), are separated by a non-conductive spacer that is connected to the meter's analog ground. The spacer provides a physical path for a zebra connector which electrically connects the two boards.

Major Components

The basic operation of the phoenix is similar to the Wavetek Model 153, and has the same type of major components.

U1	A-D converter	Holt 6008A
U7	Microcomputer	Oki MSM80C154; 8-bit, 16K ROM, 256 bytes RAM
U8	LCD Driver	NEC uP7225; serial Quadraplex driver LCD, Quadraplex display, >100 segments, 4 backplanes

Figure 1 is the system block diagram for the series 2000 units. This overview shows how the various components are connected together within the meter. Below will be discussions of each of the sections and their specific components that perform their functions under the control of the microcomputer.



MAJOR SUBSECTIONS

The following is a list of each subsection that will be discussed. All of these discussions reference the schematic of 1000-0395-00, and the LCD layout of 1000-0193-00.

Input Protection	Schematic
Switch Block	Fig. 2
Power Regulation	Schematic
A-D Conversion	Schematic
V-F Conversion	Schematic
Internal AC converter	Schematic
Voltage and Current input	Fig. 3
Ohms and Diode Test input	Fig. 4
Analog switching; 4053 (U3 and U4)	Fig. 5
RMS circuit; AD737 (U2)	Fig. 5
PEAK circuit; LF442 (U5), 4052 (U6)	Fig. 5
Frequency; 4069 (U12), 74H132 (U9), 74390 (U10), 4052 (U11)	Fig. 6
Capacitance	Fig. 7
Low Battery Test	Fig. 7
LCD and Backlight	Schematic

Input Protection

Protection for the V/OHM input jack is provided by RV1 (a high voltage MOV) in series with RT1 and R2. These components block fast transient voltages before the switches can arc over. ZR1 and ZR2 connect the MOV to other input switches while keeping the voltages separate for ohms.

In ohms, RT1 (a positive temperature-coefficient resistor) limits the current to the chip. It performs this function in conjunction with zener diodes located at the A-D chip. While in current modes, the circuit is protected by the two fuses, F1 and F2.

Switch Block

All functions of the meter are accessed from the front knob, which connects to the switch block. This meter utilizes on-board switches that are closed by metal contacts located in the knob rotor assembly. The switch ring setup is shown in Figure 2. All circuit inputs needed for a specific function, along with their computer ports are determined by this switch. It has five metal contacts that rotate through each function position. One point of interest is that ACV and DCA are exactly opposite each other. This was done purposefully because they won't interact with each other. The middle switch position is different in the rotation sequence allowing the computer to determine the function to be activated.

Power Regulation

The meter is powered by a single nine volt battery. The power regulation is done by the A-D chip. It creates system ground 6.2 volts below the positive terminal of the battery. This point is the reference for all voltage measurements and the connection point for the shield. The chip also creates a five volt digital supply (with respect to system ground) that is used by the microcomputer, LCD driver, the logic and analog switching circuits. It also develops a negative supply of five volts (with respect to system ground) using its oscillator and some diodes. This voltage will drop 0.5 volts while measuring low resistance. The A-D reference is also established here using a reference diode (VR1) of 1.23 volts.

A to D Conversion

The precision A-D Converter for the meter is an offset dual-slope type. To operate, it uses an integrating capacitor (C19), an auto-zero capacitor (C4), and the resistor network (RN2) to set the gain of the A-D Converter to 100 mV = 10000 counts. This is trimmed to value in DC volts using a potentiometer (TRM1). The A-D Converter consists of eleven states auto-zeroing, signal-integration, and reference integration. Each state is approximately 50 milliseconds, so that there will be two complete updates per second. The input for the A-D Converter is at FO on the chip right after R(, the filter resistor.

Voltage to Frequency Conversion

The on-chip voltage-to-frequency converter operates in parallel with the analog to digital converter. It has it's input at FI, which is the input side of the filter resistor R9. It also uses the auto-zero capacitor (C3), the integrating capacitor (C28), and the gain setting resistor (R5). It is trimmed with the potentiometer (TRM2) to set its gain so that full scale on the bargraph is 10000 counts. The V-F is used to drive the analog bargraph because it updates with every state change at approximately twenty times per second. Since it has a frequency output, it also drives the beeper as an audible tone proportional to the display. Auto-ranging of the meter in volts, amps and ohms is done using the V-F because we have a new update every 50 mS and this speeds up the ranging of the meter.

Internal AC Converter

The A-D chip (U1) has an internal AC converter which is of the full-wave average sensing type. Its input is at ACI. Externally, it uses R13 and R14 to set the output value of the DC voltage. It is trimmed with potentiometer TRM4, to set the gain such that it equals the RMS value of a sine wave. This AC converter is used as the front-end for the V-F converter for all AC measurements because it settles to final value faster than the external True-RMS chip, thus increasing the auto-ranging speed. It can also drive the precision A-D converter when the True-RMS capability is not needed.

Voltage and Current

Figure 3 shows how the meter is configured for volts and current. The A-D Converter chip has an internal amplifier referred to as the Main Amplifier, that determines the meter range. This is an auto-zeroed circuit that has less then 10 microvolts of input offset voltage, and a few pico-amps of bias current. The attenuator (RN1) determines the output signal of the Main-Amp. The range is set by the switches, SR0 to SR4, and are controlled by the microcomputer. When set, the Main Amp output always equals, 100 mV = 10000 counts. In DC, this signal is sent directly to the V-F, and A-D converters. In AC, it is first routed through the internal AC converter.

Ohms and Diode Test

Figure 4 shows the configuration for Ohms, and Diode test. The Main Amp is now set up to have the unknown resistor measured across its feedback from the inputs. The rest of the attenuator resistors of RN1 (1K to 9M) become the known values. They are always connected to the Ohms amplifier at -1 volts. The range is determined by the microcomputer through the setting of switches SR0 to SR4. This gives a constant current drop across the know values of -1 volts which becomes a positive voltage across the resistor being tested that translates as 100 mV = 10000 counts. It than moves on to the V-f and A-D converters. The highest resistance range and diode test use the divide-by-ten circuit consisting of the 444 kΩ and 55 kΩ resistors internally switched in by the microcomputer closing the DT switches and opening the ohm switch.

Analog Switching

Figure 5 demonstrates the switching of various circuits to accomplish deferent functions. They are listed as follows:

RMS	High = RMS function in ACV, DCV and ACA, not used with Peak switch.
PEAK	Low = Peak function in ACV and DCV, not used with RMS switch.
FILTER	Low removes the normal mode filter. This allows faster response during Peak and Capacitance.
X2	When X2 is high, the A-D gain is 100 mV = 5000 counts. This is used in Diode Test and high Meg-ohms to increase the range (to 2 volts and 20 Megohms respectively).
POWER	High turns ON power to the RMS and Peak circuits. They are kept OFF to reduce battery current drain when not used.

RMS Circuit

The true RMS circuit (in Fig. 5) is used to make accurate measurements of non-sinusoidal waveforms. The circuit consists of the AD737 RMS-to-DC converter IC, with several external components. The averaging capacitor is C30. It takes to potentiometer to adjust it to final value. They are TRM3 and TRM5. The circuit input comes from ACI (the Main Amp output in AC) and connects to FO (the A-D) through R9. It than gives the reading for the RMS level of the waveform to the A-D on the chip.

Peak Circuit

The Peak circuit (in Fig. 5) is used to measure the positive and negative peaks of waveforms. The circuit consists of a dual op-amp (U5) that feed sample and hold circuits (CR17, Cr18, R26,R27, C31, and C32) to capture the peak value of the waveforms. The microcomputer then uses U6 to switch between measuring either the positive or negative value. Initially, the amplifiers can be zeroed by U6. As the voltage builds up, the highest value is kept by the microcomputer.

Frequency

The Frequency circuit is shown in Figure 6. The signal is initially conditioned to be a pulse waveform through U12. The other external components consist of CR15 and CR16 for voltage limiting, C35 to isolate the input, and feedback resistors around U6. After conditioning, it enters the frequency circuit at FREQ. Three ranges are accomplished by going through U10 and dividing down the input. Duty cycle is accomplished mixing the oscillator and one side of the frequency pulse and then dividing it by 100.

Capacitance

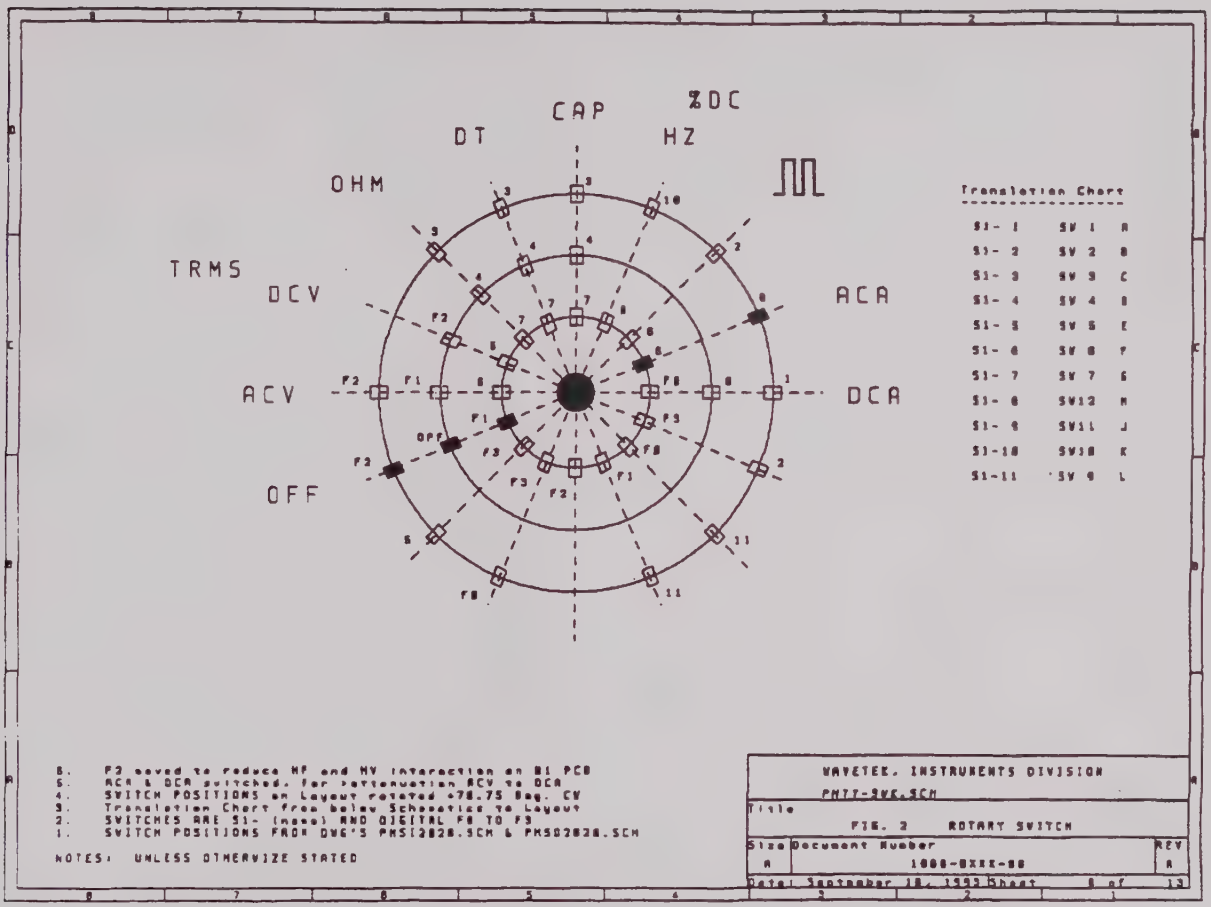
Capacitance is shown in Figure 7. This is a reverse ballistic measurement. The meter is in the Ohms configuration. The unknown is a capacitor that is shorted out by Q3 during all cycles of the A-D Converter except signal integrate. It is then opened, allowing the capacitor to charge up. This charge is measured by the A-D. Since more charge represents a smaller capacitor, this is reversed to as reverse-ballistic. The charge current is determined by the attenuator resistor values in the ohms circuit.

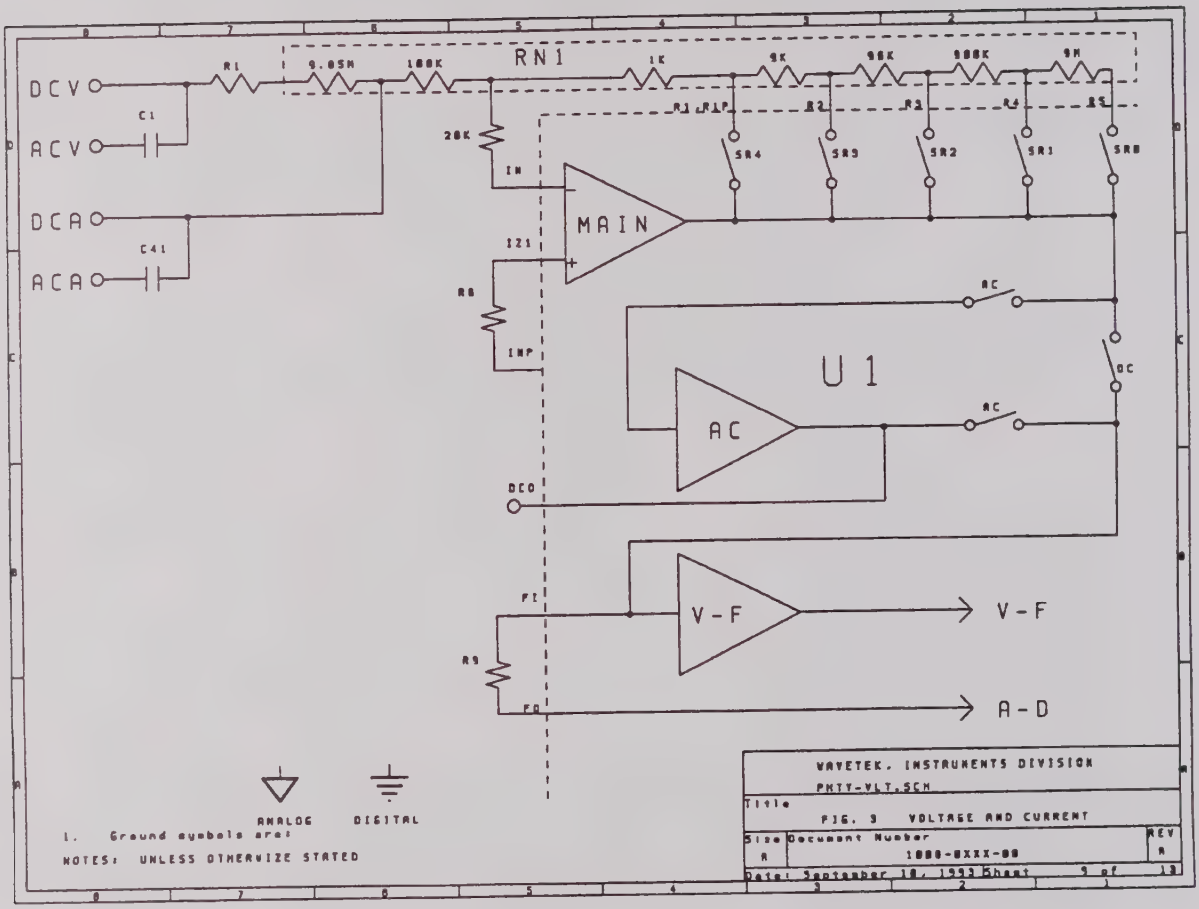
Low Battery Test

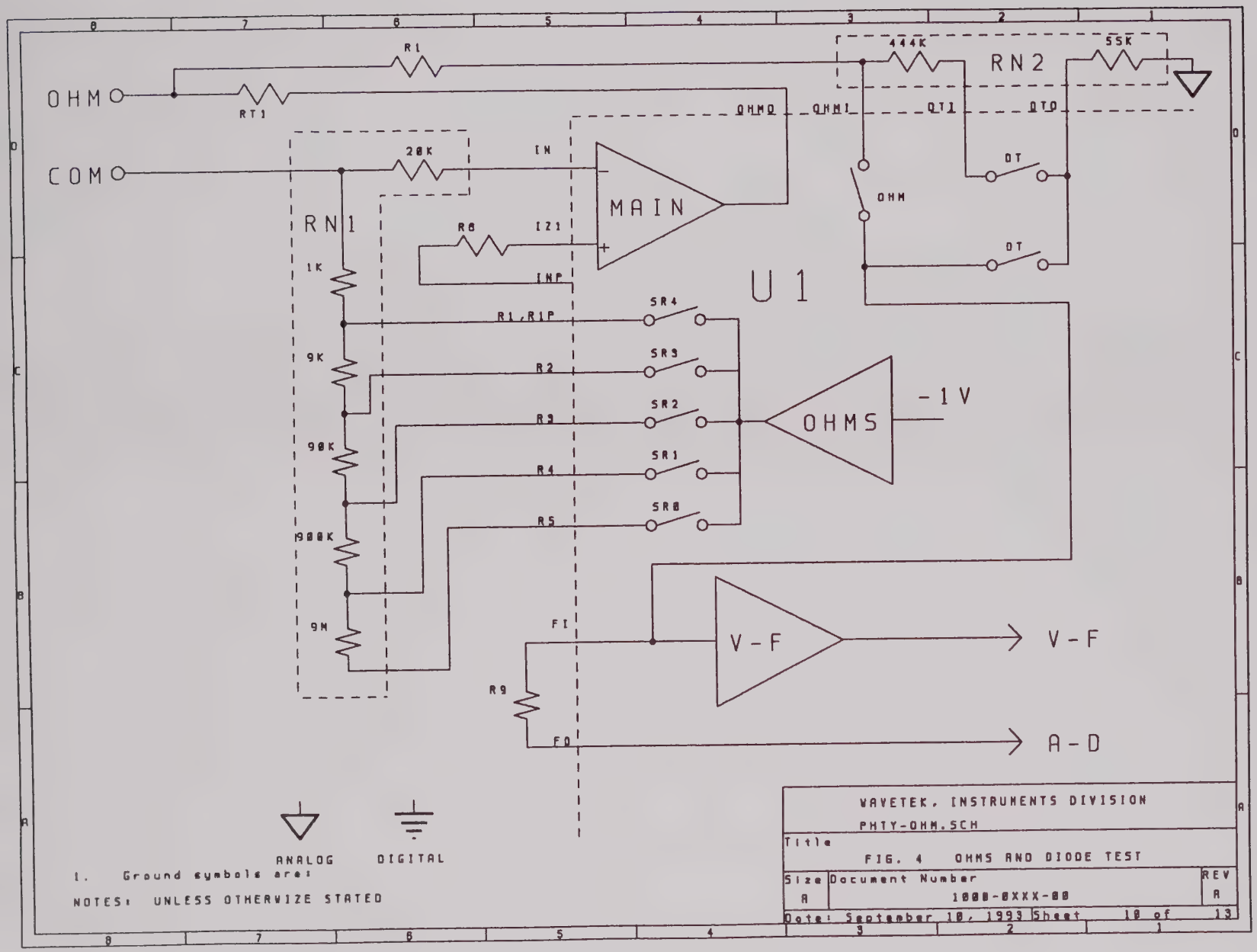
The meter performs a low-battery test on the positive power supply. This is done whenever the unit is turned on, or approximately every half-an-hour is left running with min-max recording turned on. The purpose is to assure that the battery has enough voltage left to make good measurements. If not, the meter is turned off. The circuit is shown in Figure 7. The positive power supply is regulated to 6.2 volts. When it drops more than half a volt below this value, the meter could start to give incorrect readings. This is checked by turning on Q4 with the CAP port from the microcomputer. This measures the positive power supply with the ratio of resistors R25 and R14. The V-F takes the reading and displays it on the bargraph. Q6 keeps any extra voltage from coming through the Main Amp during AC measurements.

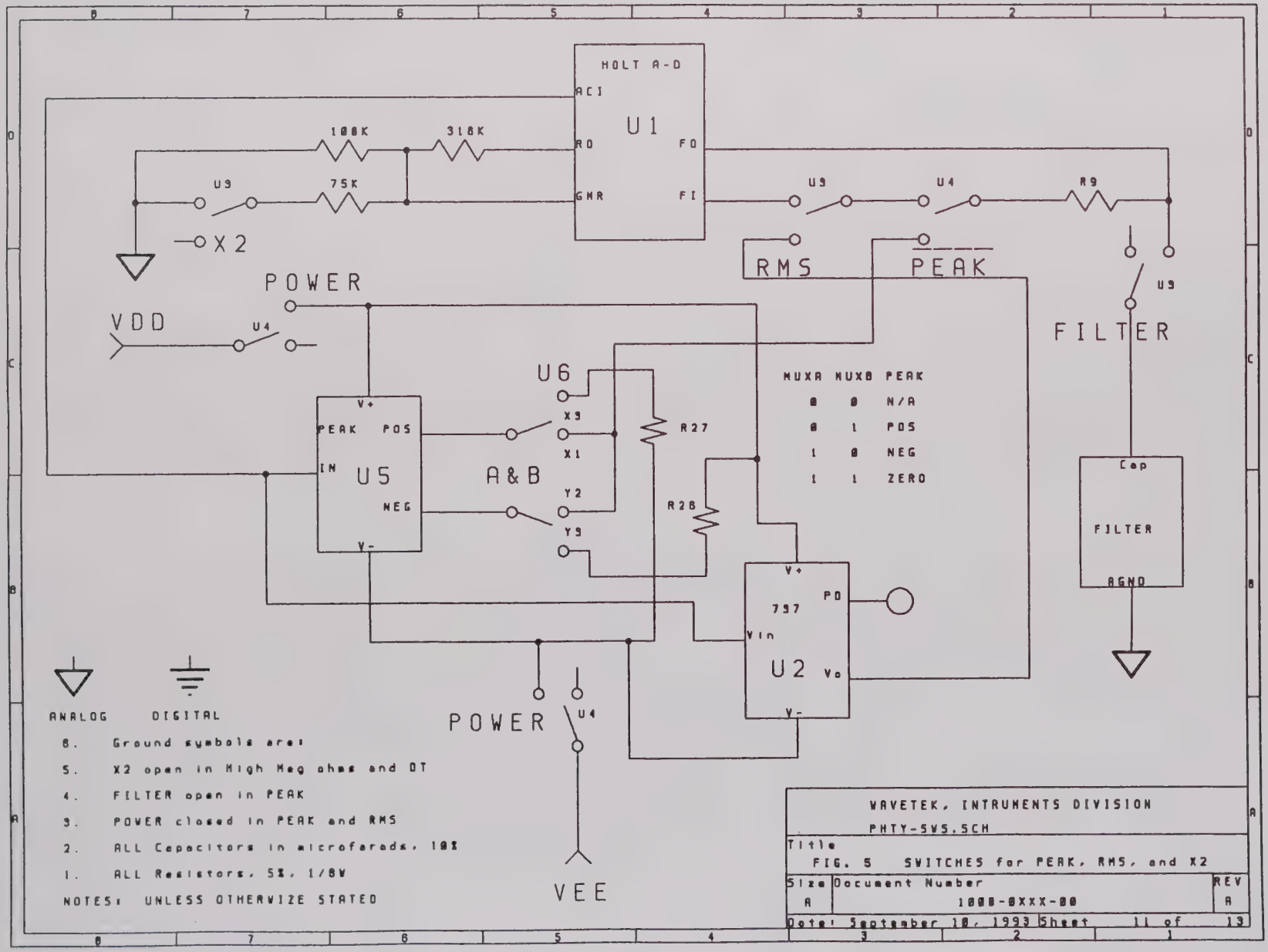
LCD

The meter uses a quadraplex (four backplanes) LCD that is driven from an LCD display driver integrated circuit. The LCD clock frequency is determined by R52. The bias network (a 1/3 drive type) is set by the ratio of resistors R55 to R58. In addition, we have a backlite for the display that comes from a port on the microcomputer. The current is dropped through the ultra-high luminance LED, which is driven across the battery. In that manner, the regulated power supply voltages are not affected by the LED current.

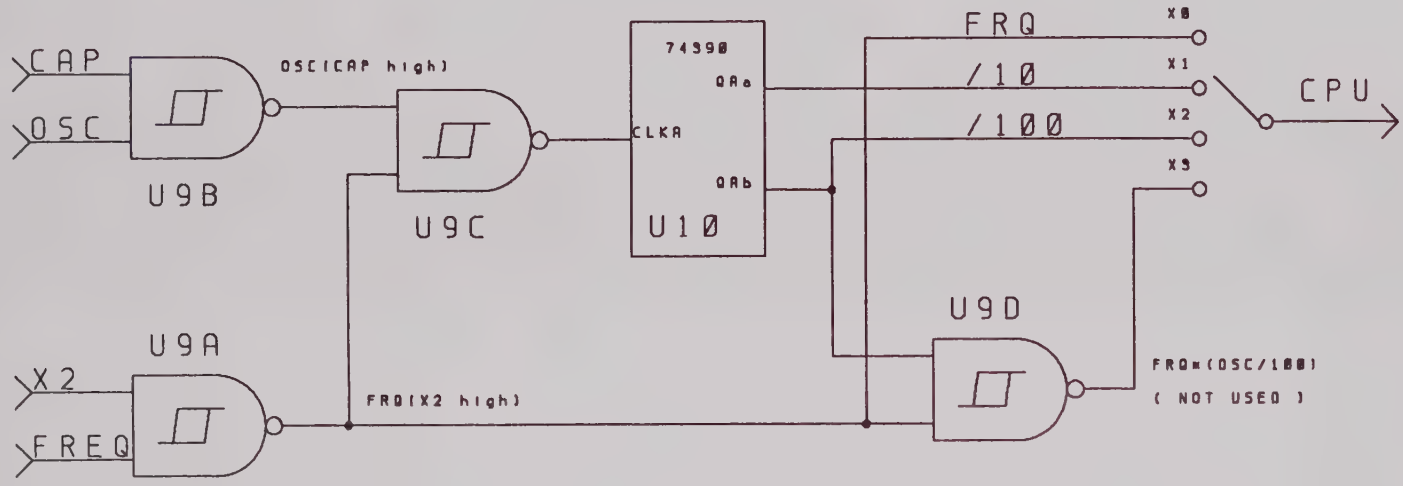

CAP
%DC
DT
HZ
OHM
TRMS
DCV
ACA
ACV
DCA
OFF
Translation Chart
S1- 1 SW 1 A
S1- 2 SW 2 B
S1- 3 SW 3 C
S1- 4 SW 4 D
S1- 5 SW 5 E
S1- 6 SW 6 F
S1- 7 SW 7 G
S1- 8 SW12 H
S1- 9 SW11 J
S1-10 SW10 K
S1-11 SW 9 L
5. F2 moved to reduce HF and HV interaction on B1 PCB
6. ACA & DCA switched, for attenuation ACV to DCA
4. SWITCH POSITIONS on Layout rotated +78.75 Deg. CW
3. Translation Chart from below Schematics to Layout
2. SWITCHES ARE S1- (none) AND DIGITAL F8 TO F3
1. SWITCH POSITIONS FROM DWG'S PMSI3828.SCH & PMSB2828.SCH
NOTES: UNLESS OTHERWISE STATED
WAVETEK, INSTRUMENTS DIVISION
PM77-SWK.SCH
Title
FIG. 2 ROTARY SWITCH
Size A
Document Number
1008-0XXX-00
REV A
Date: September 18, 1993 Sheet 8 of 13


DCV
ACV
DCA
ACA
C1
C41
R1
9.05M
100K
RN1
1K
9K
90K
900K
9M
R1
R2
R3
R4
R5
SR4
SR3
SR2
SR1
SR0
20K
IN
MAIN
I21
R8
INP
AC
DC
U1
AC
AC
DCO
FI
V-F
V-F
R9
FO
A-D
ANALOG
DIGITAL
1. Ground symbols are:
NOTES: UNLESS OTHERWISE STATED
VAVETEK, INSTRUMENTS DIVISION
PMTY-VLT.SCH
Title
FIG. 3 VOLTAGE AND CURRENT
Size
A
Document Number
1000-0XXX-00
REV
A
Date: September 18, 1993 Sheet 9 of 13


OHM
COM
R1
RT1
444K
55K
RN2
OHMO
OHM1
OT1
OT0
OT
OHM
OT
20K
IN
MAIN
RN1
R8
IZ1
INP
U1
1K
SR4
R1,R1P
9K
SR3
R2
SR2
R3
OHMS
-1V
90K
SR1
R4
SR0
R5
900K
9M
FI
V-F
V-F
R9
FO
A-D
ANALOG
DIGITAL
1. Ground symbols are:
NOTES: UNLESS OTHERWIZE STATED
WAVETEK, INSTRUMENTS DIVISION
PHTY-OHM.SCH
Title
FIG. 4 OHMS AND DIODE TEST
Size A
Document Number 1000-0XXX-00
REV A
Date: September 10, 1993 Sheet 10 of 13


HOLT A-D
U1
ACI
RO
GMR
FO
FI
100K
31.6K
75K
U3
U4
R9
X2
RMS
PEAK
POWER
VDD
FILTER
U6
X3
X1
Y2
Y3
A&B
R27
R28
V+
PEAK
POS
IN
U5
NEG
V-
MUXA MUXB PEAK
0 0 N/A
0 1 POS
1 0 NEG
1 1 ZERO
Cap
FILTER
AGND
797
PD
Vin
U2
Vo
ANALOG
DIGITAL
8. Ground symbols are:
5. X2 open in High Meg ohms and DT
4. FILTER open in PEAK
3. POWER closed in PEAK and RMS
2. ALL Capacitors in microfarads, 10%
1. ALL Resistors, 5%, 1/8W
NOTES: UNLESS OTHERWISE STATED
VEE
WAVETEK, INTRUMENTS DIVISION
PHTY-SWS.SCH
Title
FIG. 5 SWITCHES for PEAK, RMS, and X2
Size A
Document Number 1008-8XXX-00
REV A
Date: September 10, 1993 Sheet 11 of 13

CAP	X2	CLKA
0	0	LOW
0	1	FRQ
1	0	OSC
1	1	FRQ*OSC



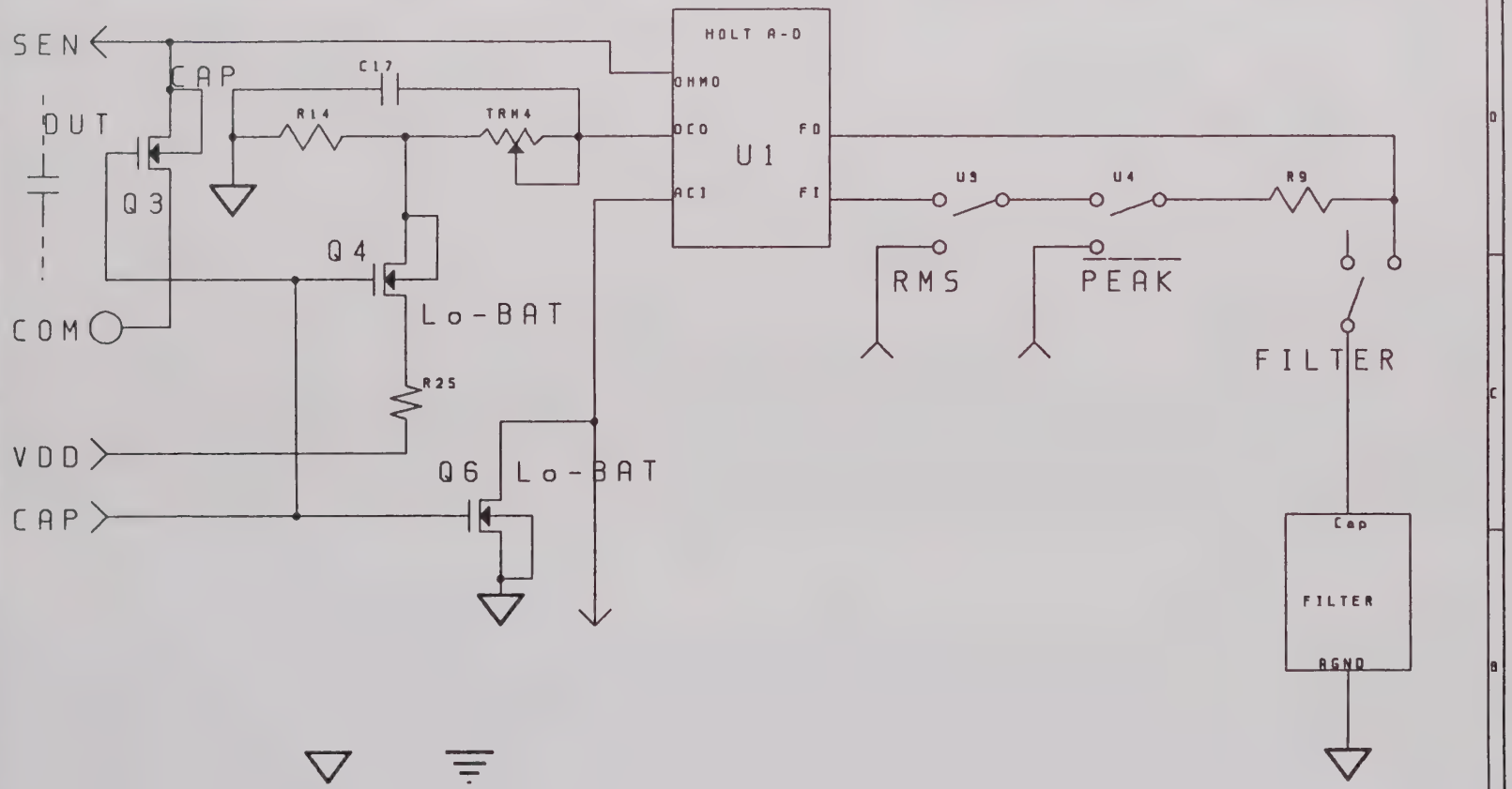
4. FRQ anded with OSC for duty cycle count

ANALOG DIGITAL

3. Ground symbols are:
2. ALL Capacitors in microfarads, 10%
1. ALL Resistors, 5%, 1/8W

NOTES: UNLESS OTHERWIZE STATED

WAVETEK, INTRUMENTS DIVISION		
PHTY-FRQ.SCH		
Title: FIG. 8 FREQUENCY CIRCUIT		
Size: A	Document Number: 1008-0XXX-00	REV: A
Date: September 10, 1993	Sheet 12 of 13	



7. Ground symbols are:
8. Low Battery done when CAP is high in AC
5. CAP high discharges DUT
4. Capacitor DUT from SEN to COM
3. FILTER open during Capacitance
2. ALL Capacitors in microfarads, 10%
1. ALL Resistors, 5%, 1/8W

NOTES: UNLESS OTHERWISE STATED

WAVETEK, INTRUMENTS DIVISION		
PHTY-CAP.SCH		
Title: FIG. 7 CAPACITANCE and LOW BATTERY		
Size: A	Document Number: 1000-0XXX-00	REV: A
Date: September 10, 1993	Sheet 13 of 13	

Troubleshooting

The major signals are listed below. They are measured from system ground, which is always the shields, and are COM in AC and DC volts. There should be a new battery of greater than nine volts applied to the unit.

TP	NAME	LOCATION	READING	COMMENTS
	IDD	Battery	2.5 +/-0.5 mA	Operating in DC volts
	IDD BK	Battery	25 +/-5.0 mA	Current for meter when backlite is ON.
	Isby	Battery	< 15 uA	Meter in the OFF position
	VDD	U1 pin 59	6.3 +/-0.3 V	
	VD2	U1 pin 62	5.1 +/-0.3 V	
	Ref	RN2 pin 7	-1.22 +/-0.05 V	
	VEE	U1 pin 37	-5.0 +/-0.3 V	If not present, probably no oscillator
	OSC	U7 pin 14	1 MHz	
5 Volt Logic Levels				
1	TP2VF	U7 pin 3	PP 48 mS	Shows the period of each state
2	B3	U7 pin 21	Data	
3	A3	U7 pin 25	Data	
4	ALE	U7 pin 27	166.7 kHz	Use this point to check the oscillator
5	MUX A	U7 pin 44	Data	
6	MUX B	U7 pin 1	Data	
7	*RESET	U8 pin 13	Low	Reset must go high, than low

3 Year Warranty Against Defects

The SERIES 2000 multimeters are warranted against all defects of material or workmanship which develop for any reason whatsoever, except abuse, within a period of three (3) years of the date of purchase of the multimeter by the original buyer. This warranty is extended only to the original buyer or original user of the multimeter, who must present proof of purchase at the time of warranty service.

In the USA any multimeter claimed to be defective during the warranty period should be returned with proof of purchase to a Wavetek Factory Service Center. Repair is typically made within two working days. Follow the shipping instructions as detailed in the service section at the back of this manual. For warranty repair outside the USA, contact your local Wavetek Instrument dealer, or the distributor where your multimeter was purchased, or return it to a Wavetek Factory Service Center.

ANY IMPLIED WARRANTIES ARISING OUT OF THE SALE OF A WAVETEK MULTIMETER, INCLUDING BUT NOT LIMITED TO IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, ARE LIMITED IN DURATION TO THE ABOVE STATED PERIODS. WAVETEK CORPORATION SHALL NOT BE LIABLE FOR LOSS OF USE OF THE MULTIMETER OR OTHER INCIDENTAL OR CONSEQUENTIAL DAMAGES, EXPENSES, OR ECONOMIC LOSS, OR FOR ANY CLAIM OR CLAIMS FOR SUCH DAMAGE, EXPENSES, OR ECONOMIC LOSS.

Some states do not allow limitations on how long implied warranties last or the exclusion or limitation of incidental or consequential damages, so the above limitations or exclusions may no apply to you.

This warranty gives you specific legal rights, and you may also have rights which vary from state to state.

After-Warranty Repair or Exchange Service

After-warranty service is provided by the Wavetek Instrument Division in two ways. You may elect to have your instrument repaired at an authorized Wavetek repair facility, or you can exchange your defective out-of-warranty instrument for a reconditioned instrument at a flat rate as listed on Wavetek's current price list. Contact any authorized Wavetek Distributor or Wavetek Instrument Division, for the current non-warranty replacement rates and instructions for shipping the instrument.

Calibration Service

Each Wavetek multimeter should be calibrated once a year or after it is repaired. The procedure to accomplish this is contained in this manual. If you do not have the necessary equipment specified to complete calibration, this can be performed by an authorized Wavetek Service Center. If you wish to take advantage of this service, contact any authorized Wavetek Distributor, repair facility, or Wavetek Instrument Division for current calibration rates and instructions for shipping the instrument.

Section IV Service Procedures

This section provides the qualified service technician with instructions for cleaning, battery removal and replacement and disassembly and re-assembly as well as a summary of warnings and precautions.

WARNINGS!

When used in this manual is to advise the user of a hazard that could result in serious injury or even death. The Symbol "W" refers to the user to the "WARNINGS AND PRECAUTIONS" in this section.

PRECAUTIONS!

When used in this manual is to advise the user of a hazard that could cause damage or malfunction in the instrument. The symbol "P" refers the user to the "WARNINGS AND PRECAUTIONS" in this section.

"W"	**WARNING** **To avoid electrical shock, disconnect the meter from all voltage sources before the case is opened. Close the case before returning the meter to service.**

"P"	**PRECAUTION** **Before performing any calibration or repair procedures, make sure you are wearing a wrist or ankle ground strap to prevent component damage due to electrostatic discharge.**

CLEANING INSTRUCTIONS

The Series 2000 multimeters may be wiped clean with a damp soft cloth. To prevent scratching of the protective display lens, it should be cleaned with lens paper or a nonabrasive cloth that is specially designed for cleaning acrylic plastic.

REQUIRED TOOLS AND EQUIPMENT

The tools required for calibration, maintenance, and repair of the Series 2000 multimeters include the following:

Fluke 5100 calibrator or equivalent source
#1 Phillips head screwdriver
Small flat blade screwdriver
Jewelers flat blade screwdriver (for calibration)
Calibrated voltmeter (for calibration) with at least 0.01V resolution and 0.1% (rdg) accuracy.
Stable power supply (for calibration) with at least 0.001V resolution and 0.1% (rdg) accuracy.

BATTERY REPLACEMENT

When the symbol on the display is lit, less than 50 hours of battery life remains. The following steps describe battery removal and replacement.

1. Turn the multimeter off and remove the test probes.
2. Remove multimeter from holster.
3. Remove the three (3) screws holding the front and rear case halves together. Separate the front and rear case halves.
4. Remove and replace the battery with a NEDA type 1604 or equivalent 9 VDC alkaline battery.
5. After installing a new battery, assemble the meter using the reverse of the above procedures.
6. Reinstall multimeter into holster and connect the test leads.

DISPLAY SEGMENT TEST

To assure that the zebra connectors and the rest of the meter's components have been re-assembled correctly, perform the segment display test.

1. With the meter fully assembled, rotate the function switch to any position except the "Off" position.
2. All of the display segments will light for approximately 2 to 5 seconds.

CLEANING/REPLACEMENT OF ELASTOMER CONNECTORS

If the display segments do not function properly, the elastomer (zebra) connectors may need to be replaced or cleaned. A zebra connector consists of conductive carbon traces sandwiched between two foam pads.

Remove dust from the zebra connectors by dusting with a short bristle camel's hair brush. If grease or fingerprint contamination is suspected, clean the connector with alcohol and allow it to air dry. Do not wipe the connector with a fibrous material since excessive lint can cause a poor connection.

CALIBRATION

To maintain the accuracy specifications of the Series 2000 Digital Multimeters, it is recommended that the multimeter be calibrated at least once a year and immediately after all repairs.

Calibration consists of applying both a calibrated DC and AC voltage for the appropriate display reading. Refer to the drawings and schematics.

Calibration Procedure for Model 2010

Procedures:

1. DC Calibration
   With no input, turn the unit on and set it to DCV. By-pass the low battery test by holding down the deselect button. Set Range Lock to 1000.0 mV.

   TRM1 DC display adjust:
   Apply +800.0 mVDC between VOLTS and COM inputs.
   Adjust TRM1 until display reads 800.0 ±0.4 mV.

   TRM2 DC bargraph adjust:
   Apply +800.0 mVDC between VOLTS and COM inputs.
   Adjust TRM2 until bargraph pointer indicates 8 on the scale.

2. AC Calibration
   Remove the input, change the function to VAC. Set Range Lock to 1000.0 mV.

   TRM4 Internal AC adjust:
   Apply 800.0 mVAC at 200 Hz between VOLTS and COM inputs.
   Adjust TRM4 until bargraph pointer indicates 8 on the scale.
   Alternate: Adjust TRM4 until display reads 800.0 ±0.4 mVAC.

3. Frequency Compensation
   Remove the input, and verify that the function is set to VAC

   CA2 AC 1V adjust:
   Apply 800.0 mVAC at 5000 Hz between VOLTS and COM inputs. The unit should range to 1000.0 mVAC range.
   Adjust CA2 until display reads 798.0 ±1.0 mVAC.

   CA1 AC 10V adjust:
   Apply 8.000 VAC at 5000 Hz between VOLTS and COM inputs. The unit should range to 10.000 VAC range.
   Adjust CA1 until display reads 7.900 ±0.01 VAC.
   CA1 and CA2 are iterative trims Repeat both adjustments until both are within their specified limits.

Calibration Procedure for Model 2020 and 2030

Procedure:

1. DC Calibration
   With no input, turn the unit on and set it to DCV. By-pass the low battery test by holding down the deselect button. Set Range Lock to 1000.0 mV.

   TRM1 DC display adjust:
   Apply +800.0 mVDC between VOLTS and COM inputs.
   Adjust TRM1 until display reads 800.0 ±0.4 mVDC (2020) or ±0.2 mVDC (2030).

   TRM2 DC bargraph adjust:
   Apply +800.0 mVDC between VOLTS and COM inputs.
   Adjust TRM2 until bargraph pointer indicates 8 on the scale.

2. AC Calibration
   Remove the input, change the function to VAC. Set Range Lock to 1000.0 mV.

   TRM4 Internal AC adjust:
   Apply 800.0 mVAC at 200 Hz between VOLTS and COM inputs.
   Adjust TRM4 until bargraph pointer indicates 8 on the scale.
   Alternate: Press the second function button and backlight button at the same time to use the internal AC Converter. Adjust TRM4 until display reads 800.0 ±0.4 mVAC.

3. AC RMS Calibration
   Remove the input, change the function to VDC. Set Range Lock to 1000.0 mV. Press the second function button for AC+DC. This will be an iterative trim.

   TRM5 RMS Balance adjust:
   Apply +500.0 mVDC, then -500.0 mVDC between VOLTS and COM inputs.
   Adjust TRM5 until display reads the same absolute number ±2 counts.

   TRM3 RMS Level adjust:
   Apply +500.0 mVDC between VOLTS and COM inputs.
   Adjust TRM3 until display reads 500.0 ±0.4 mV.
   TRM3 and TRM5 are iterative trims Repeat both adjustments until both are within their specified limits. This may require doing only coarse adjustments at first until readings are close to final values.

4. Frequency Compensation
   Remove the input, and change the function to VAC

   CA2 AC 1V adjust:
   Apply 800.0 mVAC at 5000 Hz between VOLTS and COM inputs. The unit should range to 1000.0 mVAC range.
   Adjust CA2 until display reads 798.0 ±1.0 mVAC.

   CA1 AC 10V adjust:
   Apply 8.000 VAC at 5000 Hz between VOLTS and COM inputs. The unit should range to 10.000 VAC range.
   Adjust CA1 until display reads 7.900 ±0.01 VAC.
   CA1 and CA2 are iterative trims Repeat both adjustments until both are within their specified limits.

Section V Replacement Parts and Schematics

The replacement parts and supplies listed in this section may be ordered from Wavetek Instruments Division, or your local service center. Prices and availability for all parts can be obtained by calling the Wavetek Instrument Repair Dept. Please have the full part number, description and quantity of the desired parts available before calling.

To determine the Wavetek part number and description of the part to be replaced, find the part number on the appropriate illustration. Next, note the illustration figure number or parts index number. Locate the figure number on the parts list and verify the description.

Written orders should be sent to the address shown below and should include a check or money order for the full amount of the order. Alternately, company purchase orders can be faxed to the attention of the Instrument Repair Dept.

The Wavetek Instruments Division address is:

Wavetek Instruments Division
Instrument Repair Dept. (DMM's)
9045 Balboa Ave., Suite A
San Diego, CA 92123
Phone: (619) 279-2200 x670 Repair Dept. and Parts order ONLY.
Fax: (619) 495-3296 Repair Dept. and Parts order ONLY.

Main Board Schematic	1000-0395-01
Main Board Locator Drawing, Thru Hole (2010)	1000-0394-10
Main Board Material List	1000-0394-10
Main Board Locator Drawing, Thru Hole (2020)	1000-0394-01
Main Board Material List	1000-0394-01
Main Board Locator Drawing, Thru Hole (2030)	1000-0394-30
Main Board Material List	1000-0394-30
Main Board Locator Drawing, SMT (2010)	1000-0458-10
Main Board Material List SMT	1000-0458-10
Main Board Locator Drawing, SMT (2020)	1000-0458-01
Main Board Material List SMT	1000-0458-01
Main Board Locator Drawing, SMT (2030)	1000-0458-30
Main Board Material List SMT	1000-0458-30
LCD (PCI and Crystaloid)	1000-0193-00

Case Pictorial, Series 2000	1000-0504-00
Case Pictorial, 2010, Material List	1000-0751-00
Case Pictorial, 2020, Material List	1000-0457-00
Case Pictorial, 2030, Material List	1000-0752-00

DES	N. NEAVEH	06 05 92		
CHK			SCHEMATIC, MAIN BD	
APPVD				
MFG			1000-0395-01	C
APPVD				
MKT				SHT 1 OF 2

REV	E.O. NO.	DATE	DSN BY	APPVD
C	2-12762	11-17-92	NN	
B	2-12704	07 08 92	NN	

| | | | |

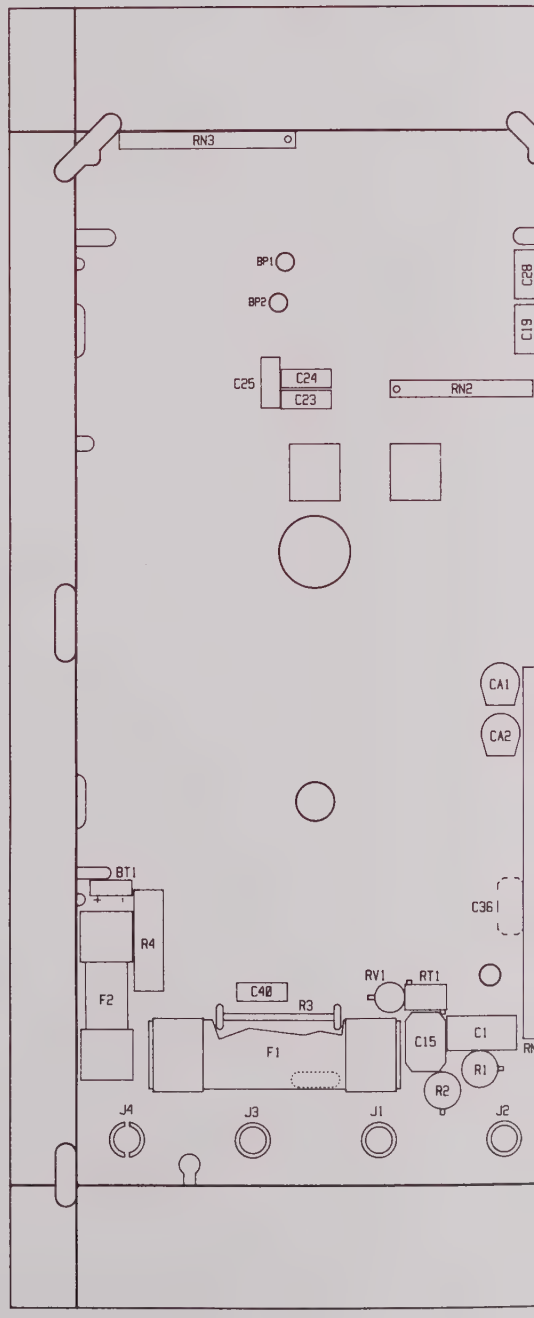
VDD
VD2
DGND
TP2VF
POWER
B0
B1
B2
B3
A0
A1
A2
A3
FILTER
$PEAK
X2
MUXA
MUXB
RMS
CAP
OSC/6
MSM83C154VGS
U7
VCC
VSS
VSS
P3.2/INT0
P3.3/INT1
P3.4/T0
P2.0
P2.1
P2.2
P2.3
P2.4
P2.5
P2.6
P2.7
P1.0/T2
P1.1/T2EX
P1.2
P1.3
P1.4
P1.5
P1.6
P1.7
XTAL2
XTAL1
RESET
NC
NC
NC
P0.0
P0.1
P0.2
P0.3
P0.4
P0.5
P0.6
P0.7
EA
ALE
PSEN
P3.0/RXD
P3.1/TXD
P3.5/T1
P3.6/WR
P3.7/RD
C54
47
Y1
1MHz
C52
18pf
C53
18pf
C51
10
R61
100
5%
U12A
CD4069
SW5 SELECT
SW4 CLEAR
SW3 MENU LT
SW2 MENU RT
SW1N F0
SW1P F1
SW1Q F2
SW1R F3
RN3
22K
2%
R52
1M
5%
2010 ONLY
U9B
U9C
U9A
U9D
74HC132
U10
74HC390
FREQ&DCLOSC
ClkBa
ClkAa
QDa
QBa
QCa
QDb
ClkAb
QAb
VCC
QAa
ClkBb
QBb
QCb
Reseta
Resetb
GND
MUX-4052
VDD
INH
A
B
X
Y
VSS
VEE
X0
X1
X2
X3
Y0
Y1
Y2
Y3
U11
FREQ
/1
/10
/100
U12E
U12B
U12C
U12D
U12F
R53
1M
5%
R54
100K
R62
10M
5%
CR19
1N914
CR20
1N914
Q5
PN2907
R50
470
R51
470
LED1
B-
R58
10K
5%
R60
100K
U8
82P822256
RESET
RDCK
RCS
RBUSY
VSS
SBYNCH
CLK2
CLK1
VLC1
VLC2
VLC3
R52
100K
R55
100K
R56
100K
R57
100K
R59
100K
C55
.1
C56
.1
C57
.1
Z1
NC
DS1
:
−①
B1C1
1■
A2
B2
C2
10■
F2
G2
E2
D2
A3
B3
C3
100■
F3
G3
E3
D3
A4
B4
C4
1000■
F4
G4
E4
D4
A5
B5
C5
F5
G5
E5
D5
K
M
Ω
HZ
μ⑤
m⑥
V
A
n
μ⑤
m⑦
F
AC
%
DC
SCALE
HLD
REL
PK
MX
MN
−②
AV
RNG
0-10
✓HLD
✓REL
✓MX-MNAV
✓PK
✓RNG
BG40
BG36
BG37
BG38
BG39
BG35
BG34
BG33
BG32
BG28
BG29
BG30
BG31
BG27
BG26
BG25
BG24
BG20
BG21
BG22
BG23
BG19
BG18
BG17
BG16
BG12
BG13
BG14
BG15
BG11
BG10
BG9
BG8
BG4
BG5
BG6
BG7
BG3
BG2
BG1
BG0
BP1
BP2
BP3
BP4

1000-0395-01 C

SHT 2 OF 2

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.
2. CAPS C31 & C32 ARE INSTALLED LAYING FLAT TO BOARD.
3. CAPACITOR C36 NOT INSTALLED AT THIS TIME.



REV	E.O. NO.	DATE	INC BY	APPVD
G	2-12935	091593	JJ	
F	2-12864	060793	JJ	
E	2-12811	042693	LO	
D	2-12824	042693	LO	
C	2-12762	111792	NN	
B	2-12753	110192	JS	
BX1	R & D	102192	LO	

DR. LOFTEDAHL	102192	
CHECK		
DESIGN		
ENG.		
APPVD.		
APPVD.		

DO NOT
SCALE DRAWING

WAVETEK

TITLE
PCB ASSY, THRU-HOLE

SIZE	CAGE CODE	DWG. NO.	REV.
D	23338	1000-0394-10	G

SCALE 2X SIZE	MODEL 2010	SHEET 1 of 3

WAVETEK
MATERIAL LIST

DRAWING NO. 1000-0394-10 REV. G

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2010	09/15/93	2 of 3

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB ASSY, SMD, 2000 SERIES	1000-0458-10	1	END USE ON 11-1-93
1	PCB ASSY, SMD, 2000 SERIES	1000-0458-11	1	START USE ON 11-1-93
2	SCHEMATIC, 2000 series	1000-0395-01	Ref	
3	PCB, SPACE DIAGRAM	1000-0485-00	Ref	
4				
5				
6	CAP, CERAMIC DISC HIGH VOLTAGE, 150pF	3000-140-100	1	C15
7	CAP, POLYCARBONATE 2.5%, .0068uF	3000-130-128	1	C28
8	CAP, MET POLYESTER 400V, .022uF	3000-130-117	1	C1
9	CAP, MET POLYESTER 100V, .015uF	3000-130-114	3	C23,24,25
10	CAP, MET POLYESTER 63V, .22uF	3000-130-116	3	C19, C31, C32
11	CAP, CERAMIC, 1.5KV +/-.1pf, 8.0pf	906-0002-00	0	*C36 NOTE: DO NOT INSTALL AT THIS TIME
12				
13	PTC, 600	3000-80-103	1	RT1
14	MOV. 1720V	3000-80-102	1	RV1
15	RES, MF, 2E, 2%, 51K, 3W	3000-50-125	1	R1
16	RES, SHUNT, .5%, .01	3000-40-102	1	R3
17	RES, WW, 3W, .25%, 9.99	3000-70-106	1	R4
18	RES, FLAMEPROOF, 3W, 5%, 220 OHM	952-0000-00	1	R2
19	RES. NTWK, ATTENUATOR	950-0900-01	1	RN1
20	Res, Network, Thick Film Ref. Divider	3000-300-116	1	RN2
21	RES NTWK, 10 SIP, 220K	950-0220-02	1	RN3
22				
23	Fuse, 15AMP/600V, High Energy	3000-400-214	1	F1
24	Fuse, 1/4AMP/600V	3000-400-121	1	F2

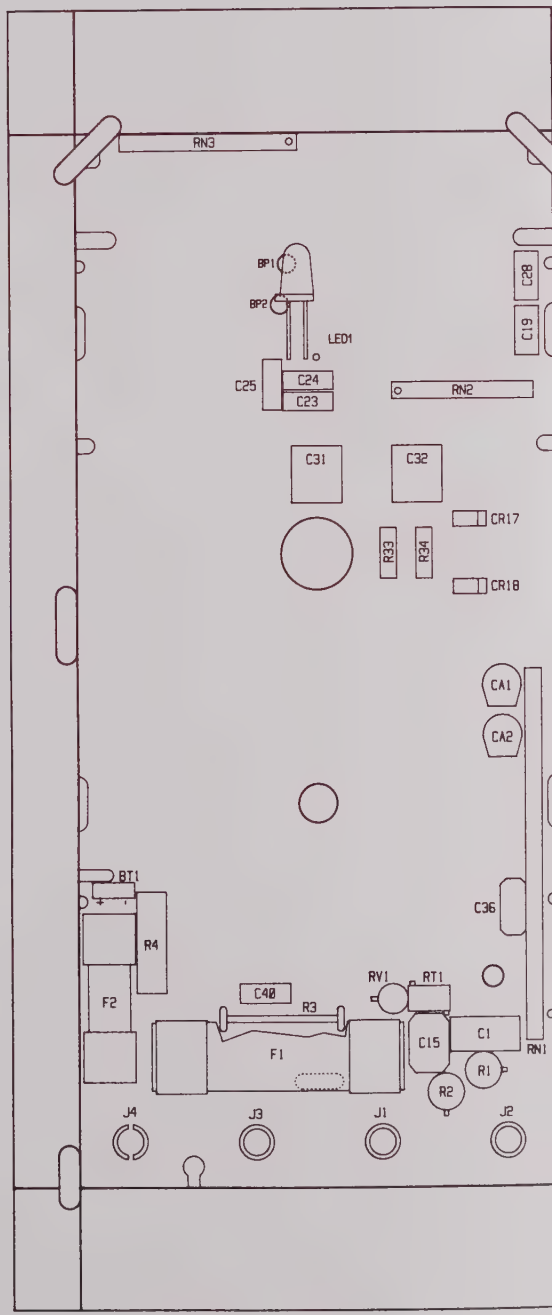
DRAWING NO. 1000-0394-10 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2010	09/15/93	3 of 3

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
25	CAP, TRIMMING, 10-120 pf	914-1000-00	1	CA1
26	CAP, VAR. 4.2-20P	903-204-00	1	CA2
27	CAP, 5%, 50V MIN, .0033uF	912-0033-50	1	C40
28				
29	CONN, BATTERY SNAP	3000-370-187	1	BT1
30	Fuse, Clip, 1/4" (Earless)	3000-370-287	2	F2
31	FUSE CLIP, 13/32"	1000-0512-00	2	F1
32	POLY TUBE,, 10A JACK	1000-0790-00	1	(J4)
33	SPLIT INPUT JACK	1000-0488-01	2	J4
34	JACK, INPUT	1000-0487-00	3	J1,J2,J3
35				
36				
37				
38	SPRING CONTACT	1000-0533-00	2	BP1,BP2

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.
2. CAPS C31 & C32 ARE INSTALLED LAYING FLAT TO BOARD.
3. INSTALL LED ORIENTED AS SHOWN.



REV	E.O. NO.	DATE	INC BY	APPVD
01G	2-12935	091593	JJ	
01F	2-12811	042693	LO	
01E	2-12824	042693	LO	
01D	2-12762	111792	NN	
01C	2-12745	100992	JS	LO
01B	2-12704	072292	LO	LO
BX11	R & D	032392	LO	
BX10	R & D	031392	LO	
BX9	R & D	011692	LO	

DR. LOFTEDAHL	011692	
CHECK		
DESIGN		
ENG.		
APPVD.		
APPVD.		

DO NOT
SCALE DRAWING

WAVETEK

TITLE
PCB ASSY, THRU-HOLE

SIZE	CAGE CODE	DWG. NO.	REV.
D	23338	1000-0394-01	G

SCALE 2X SIZE	MODEL 2020	SHEET 1 of 3

DRAWING NO. 1000-0394-01 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2000 SERIES	09/15/93	2 of 3

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB ASSY, SMD, 2000 SERIES	1000-0458-01	1	END USE ON 12-1-93
1	PCB ASSY, SMD, 2000 SERIES	1000-0458-30	1	START USE ON 11-1-93
2	SCHEMATIC, 2000 series	1000-0395-01	Ref	
3	PCB, SPACE DIAGRAM	1000-0485-00	Ref	
4				
5				
6	CAP, CERAMIC DISC HIGH VOLTAGE, 150pF	3000-140-100	1	C15
7	CAP, POLYCARBONATE 2.5%, .0068uF	3000-130-128	1	C28
8	CAP, MET POLYESTER 400V, .022uF	3000-130-117	1	C1
9	CAP, MET POLYESTER 100V, .015uF	3000-130-114	3	C23,24,25
10	CAP, MET POLYESTER 63V, .22uF	3000-130-116	3	C19, C31, C32
11	CAP, CERAMIC, 1.5KV +/-.1pf, 8.0pf	906-0002-00	0	*C36 NOTE: DO NOT INSTALL AT THIS TIME
12				
13	PTC, 600	3000-80-103	1	RT1
14	MOV. 1720V	3000-80-102	1	RV1
15	RES, MF, 2E, 2%, 51K, 3W	3000-50-125	1	R1
16	RES, SHUNT, .5%, .01	3000-40-102	1	R3
17	RES, WW, 3W, .25%, 9.99	3000-70-106	1	R4
18	RES, FLAMEPROOF, 3W, 5%, 220 OHM	952-0000-00	1	R2
19	RES. NTWK, ATTENUATOR	950-0900-01	1	RN1
20	Res, Network, Thick Film Ref. Divider	3000-300-116	1	RN2
21	RES NTWK, 10 SIP, 220K	950-0220-02	1	RN3
22				
23	Fuse, 15AMP/600V, High Energy	3000-400-214	1	F1
24	Fuse, 1/4AMP/600V	3000-400-121	1	F2

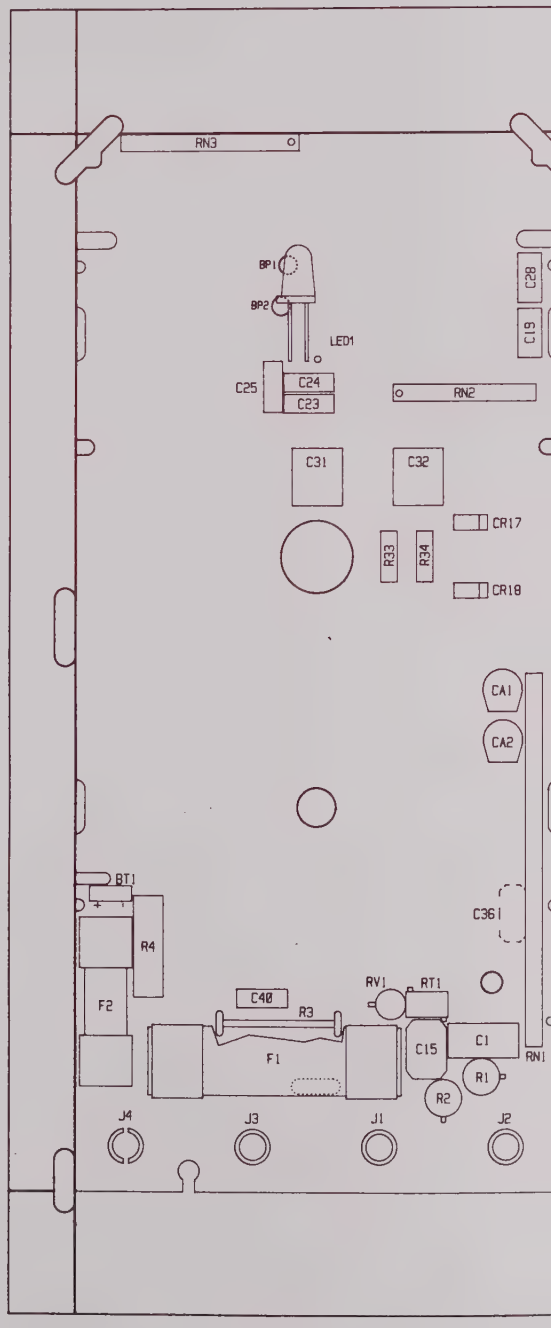
DRAWING NO. 1000-0394-01 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2000 SERIES	09/15/93	3 of 3

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
25	CAP, TRIMMING, 10-120 pf	914-1000-00	1	CA1
26	CAP, VAR. 4.2-20P	903-204-00	1	CA2
27	CAP, 5%, 50V MIN, .0033uF	912-0033-50	1	C40
28	LED, RED W/TRANSPARENT EPOXY (5.6mm)	968-0100-37	1	LED1
29	CONN, BATTERY SNAP	3000-370-187	1	BT1
30	Fuse, Clip, 1/4" (Earless)	3000-370-287	2	F2
31	FUSE CLIP, 13/32"	1000-0512-00	2	F1
32	POLY TUBE,, 10A JACK	1000-0790-00	1	(J4)
33	JACK, SPLIT INPUT	1000-0488-00	2	J4
34	JACK, INPUT	1000-0487-00	3	J1,J2,J3
35				
36	RES, CARBON 1/4W, 5%, 100M	943-201-07	2	R33,R34
37	DIODE, LOW LEAKAGE, IR=3NA @ 125V, IF=10MA @ .8V	961-091-45	2	CR17,CR18
38	SPRING CONTACT	1000-0533-00	2	BP1,BP2

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.
2. CAPS C31 & C32 ARE INSTALLED LAYING FLAT TO BOARD.
3. INSTALL LED ORIENTED AS SHOWN.
4. CAP C36 NOT INSTALLED AT THIS TIME.



REV	E.O. NO.	DATE	INC BY	APPVD
F	2-12935	091593	JJ	
E	2-12811	042693	LO	
D	2-12824	042693	LO	
C	2-12762	111792	NN	———
B	2-12754	110192	JS	———
BX2	R & D	102192	LO	———

DR. LOFTEDAHL	102192	
CHECK		
DESIGN		
ENG.		
APPVD.		
APPVD.		

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TITLE
PCB ASSY, THRU-HOLE

SIZE	CAGE CODE	DWG. NO.	REV
D	23338	1000-0394-30	F

SCALE 2X SIZE	MODEL 2030	SHEET 1 of 3

D C B A

2 1

WAVETEK
MATERIAL LIST

DRAWING NO. 1000-0394-30 REV. F

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2030	09/15/93	2 of 3

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB ASSY, SMD, 2000 SERIES	1000-0458-31	1	
2	SCHEMATIC, 2000 series	1000-0395-01	REF	
3	PCB, SPACE DIAGRAM	1000-0485-00	REF	
4				
5				
6	CAP, CERAMIC DISC HIGH VOLTAGE, 150pF	3000-140-100	1	C15
7	CAP, POLYCARBONATE 2.5%, .0068uF	3000-130-128	1	C28
8	CAP, MET POLYESTER 400V, .022uF	3000-130-117	1	C1
9	CAP, MET POLYESTER 100V, .015uF	3000-130-114	3	C23,24,25
10	CAP, MET POLYESTER 63V, .22uF	3000-130-116	3	C19,C31,C32
11	CAP, CERAMIC, 1.5KV +/-.1pf, 8.0pf	906-0002-00	0	#C36 NOTE: DO NOT INSTALL AT THIS TIME
12				
13	PTC, 600	3000-80-103	1	RT1
14	MOV. 1720V	3000-80-102	1	RV1
15	RES, MF, 2E, 2%, 51K, 3W	3000-50-125	1	R1
16	RES, SHUNT, .5%, .01	3000-40-102	1	R3
17	RES, WW, 3W, .25%, 9.99	3000-70-106	1	R4
18	RES, FLAMEPROOF, 3W, 5%, 220 OHM	952-0000-00	1	R2
19	RES, NTWK ATTENUATOR 0.560H .07%	950-0900-03	1	RN1
20	Res, Network, Thick Film Ref. Divider	3000-300-116	1	RN2
21	RES NTWK, 10 SIP, 220K	950-0220-02	1	RN3
22				
23	Fuse, 15AMP/600V, High Energy	3000-400-214	1	F1
24	Fuse, 1/4AMP/600V	3000-400-121	1	F2
25	CAP, TRIMMING, 10-120 pf	914-1000-00	1	CA1

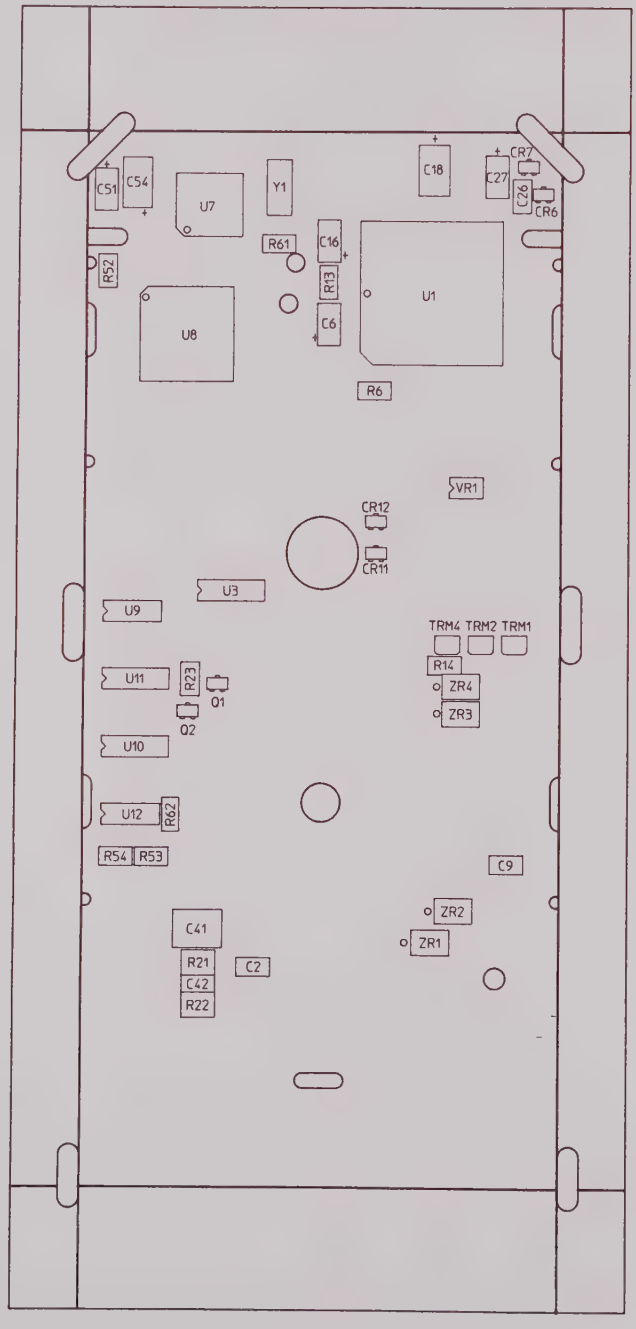
DRAWING NO. 1000-0394-30 REV. F

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN BOARD, THRU-HOLE	2030	09/15/93	3 of 3

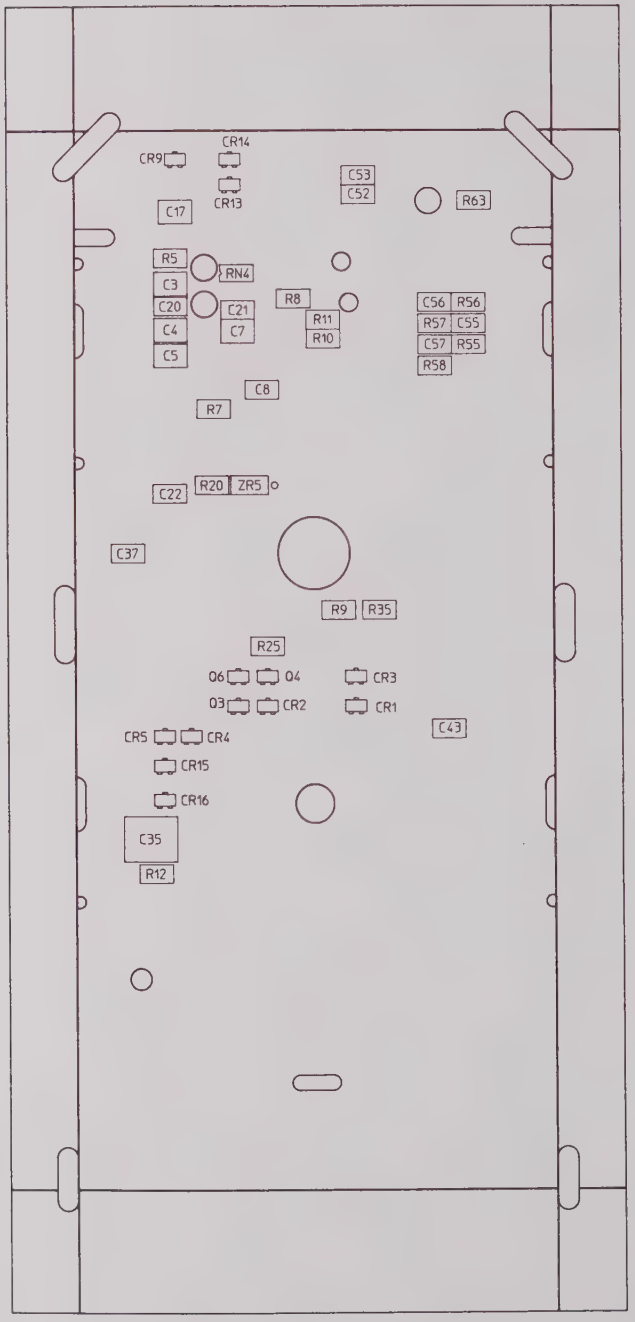
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
26	CAP, VAR. 4.2-20P	903-204-00	1	CA2
27	CAP, 5%, 50V MIN, .0033uF	912-0033-50	1	C48
28	LED, RED W/TRANSPARENT EPOXY (5.6mm)	968-0100-37	1	LED1
29	CONN, BATTERY SNAP	3000-370-187	1	BT1
30	Fuse, Clip, 1/4" (Earless)	3000-370-287	2	(F2)
31	FUSE CLIP, 13/32"	1000-0512-00	2	(F1)
32	POLY TUBE,, 10A JACK	1000-0790-00	1	(J4)
33	JACK, SPLIT INPUT	1000-0488-00	2	J4
34	JACK, INPUT	1000-0487-00	3	J1, J2, J3
35				
36	RES, CARBON 1/4W, 5%, 100M	943-201-07	2	R33, R34
37	DIODE, LOW LEAKAGE, IR=3NA @ 125V, IF=10MA @ .8V	961-091-45	2	CR17, CR18
38	SPRING CONTACT	1000-0533-00	2	BP1, BP2

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.



COMPONENT SIDE



SOLDER SIDE

D	[illegible]	[illegible]	[illegible]	
C	[illegible]	[illegible]	[illegible]	
BX3	R & D	102192	LO	
REV	E.O. NO.	DATE	INC BY	APPVD

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WAVETEK SAN DIEGO, CALIFORNIA

TITLE

PCB ASSY, SMT PARTS

SIZE	DWG. NO.	REV
D	1000-0458-10	F

SCALE 2X SIZE	MODEL 2010	SHEET 1 of 5

DRAWING NO. 1000-0458-10 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2010	04/19/93	2 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB, MAIN	1000-0396-03	1	Effectivity date: 05/15/93
2				
3	CAP, CER, MONO, NPO, 10%, 4.7PF	906-0000-06S	0	*C13 *Note: DO NOT INSTALL AT THIS TIME
4				
5	CAP, CER, MONO, NPO, 10%, 10PF	901-011-02S	2	C52,53
6				
7	CAP, CER NPO, 10%, 47PF	909-0470-00S	0	*C12
8	CAP, CER, MONO, NPO, 10%, 100PF	900-021-14S	1	C9
9	CAP, CER, MONO, NPO, 10%, 470PF	909-047-01S	1	C20 (C11 NOT USED)
10	CAP, CER, NPO, 10%, 50V, SMT, 1000PF	909-1000-00S	1	C21
11				
12	CAP, CER X7R, 10%, 4700 PF	909-047-02S	0	*C10 (NOT USED)
13				
14	CAP, .01 MFD 50V 10% MONOLITHIC CERAMIC X7R	900-021-01S	3	C2,C8,C22
15	CAP, SMD, CER, MONO, Z5U, 80/20/ .1UF	900-0210-15S	7	C26,C55,C56,C57,C37,C42,43
16	CAP, CER, MONO, Z5U, 80/20, .22UF	900-0210-16S	5	C3-5,C7,C17
17	CAP, CER, MONO, Z5U, 80/20, 1.0UF	909-0470-04S	2	C41,C35
18				
19				
20				
21	CAP, TANT, 10V, 10%, 10UF	916-010-10S	4	C6,C16,C27,C51
22				
23	CAP, TANT, 10V, 10%, 47	916-0470-10S	2	C18,C54
24				

DRAWING NO. 1000-0458-10 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2010	04/19/93	3 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
25	PCB TRACE	PCB TRACE	1	C14
26				
27				
28				
29	DIODE, SWITCHING, (1N914)	961-091-41S	14	CR1-7,CR9,CR11-16
30				
31	DIODE, ZENER, 6.2V 10%, 0.5W (1N753)	961-075-30S	1	ZR5
32	DIODE,ZENER, LOW LEAK, MIN=6.8V, MAX=13V	961-500-01S	3	ZR1-3 (DECREASE QTY TO 3 ON 6-1-93)
33	DIODE, REF, 1.235 V, +/-1%, SOB PACKAGE	961-3850-04S	1	VR1
34				
35	RES, MF, 1/8W, 5%, 10	924-5010-01S	1	R35
36				
37	RES, SMD, 5%, 100 OHMS	940-010-01S	1	R61
38	RES, MF, 1/8W, 5%, 10K	920-310-02S	1	R63
39	RES, MF, 1/8W, 5% (1206) SMT 1K	924-4100-05S	2	R7,R8
40	RES, MF, 1/8W, 5%, 2.4K	924-4205-03S	1	R5
41	RES, MF, 1/8W, 1%, 6.04K	924-4600-03S	1	R14
42	RES, MF, 1/8W, 1%, 5.76K	924-4576-02S	1	R13
43				
44	RES, SMD, MF, 1/8W, 5%, 100K	922-4100-03S	6	R52, R54-58
45				
46				
47				
48				
49	RES, MF, 1/8W, 5%, 470K	940-0470-04S	2	R21, R22

DRAWING NO. 1000-0458-10 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2010	04/19/93	4 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
50	RES, MF, 1/8W, 1%, 845K	924-4845-04S	2	R10,11
51	RES, MF, 1/8W, 5%, 1M	924-310-05S	5	R6,R20,R23,R53,R12
52	RES, MF, 1/4W, 1%, 1M	924-310-06S	1	R9
53	RES, MF, 1/8W, 1%, 604K	924-4604-03S	1	R25
54	RES, MF, 10000000 OHM 1/8W,5%	920-410-06S	1	R62
55				
56				
57				
58	RES. NTWK, GMR DIVIDER, THIN FILM	1000-0742-00	1	RN4
59				
60				
61	RES, POT, 1 TURN, 500	960-101-06S	1	TRM4
62	RES, POT, 1 TURN, 2K	960-101-07S	1	TRM2
63	RES, POT, 1 TURN, 10K	960-101-04S	1	TRM1
64				
65				
66				
67				
68				
69	IC, A/D, HOLT	1000-0094-00	1	U1
70	IC, LCD, C/DR, NEC UPD72256-00	965-5590-18S	1	U8
71	MSM83C154V-GS OKI MICROCOMPUTER SPEC.	1000-0539-00	1	U7
72				
73				
74	IC, 14052 ANALOG MULTIPLEXER DUAL 4 CH	965-5870-93S	1	U11

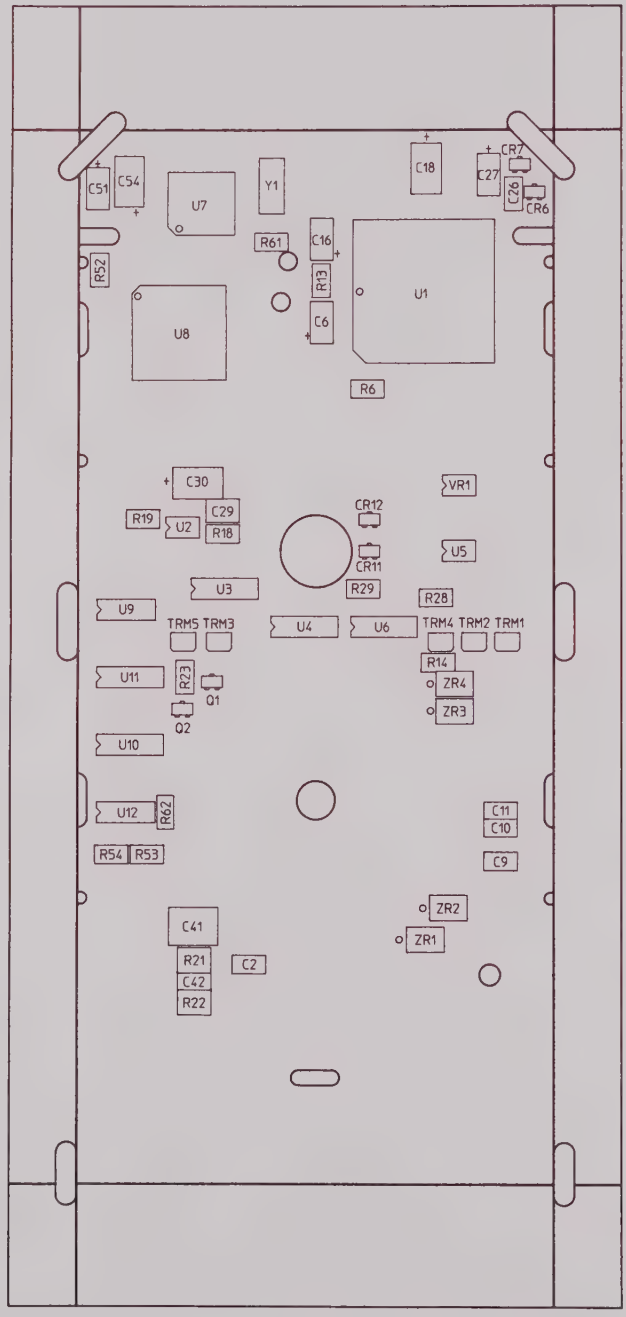
DRAWING NO. 1000-0458-10 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2010	04/19/93	5 of 5

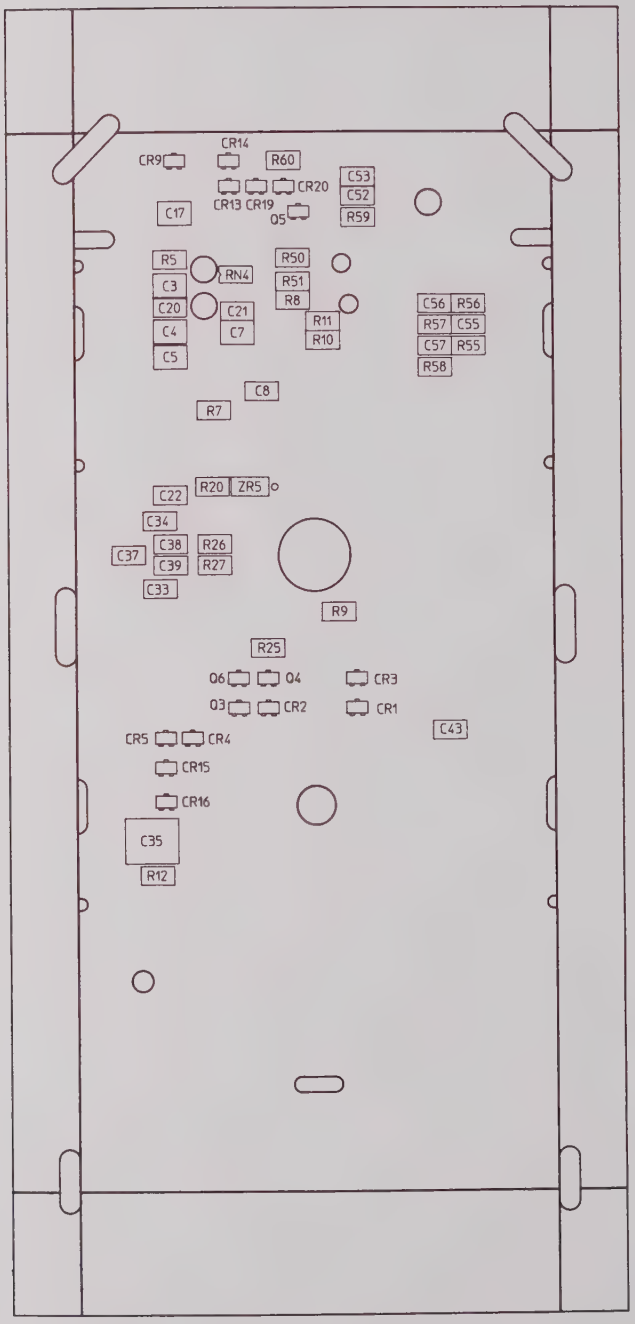
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
75	IC, 14053 ANALOG MULTIPLEXER TRIPLE 2 CH	965-5870-92S	1	U3
76	IC, NAND, 74HC132	965-6351-36S	1	U9
77	IC, COUNTER, 74HC390	965-6351-40S	1	U10
78	IC, CD4069	965-587-05S	1	U12
79				
80				
81				
82	ZN7002, N CHANNEL ENHANCEMENT XSTR	963-100-51S	1	Q3
83				
84	XSTR, FET, 2N7002 N CHANNEL	963-100-50S	4	Q1,Q2,Q4,Q6
85	1 MHZ QUARTZ CRYSTAL MINI. LOW FREQUENCY LEAD-LESS	967-005-19S	1	Y1
86	DIODE, ZENER 5.6	961-523-22S	1	ZR4 (START DATE USAGE 6-1-93)

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.
2. COMPONENTS C12, C13, CR8, CR10, R35, & R63 ARE NOT INSTALLED ON THIS ASSEMBLY.



COMPONENT SIDE



SOLDER SIDE

REV	E.O. NO.	DATE	INC BY	APPVD
01G	2-12811	4-19-93	JJ	
01E	2-12769	1-15-93	JS	
01D	2-12755	11-12-92	JS	
01C	2-12704	072392	LO	L.O.
01B	R & D	063092	LO	
008	R & D	060592	LO	
BX17	R & D	033092	LO	
BX16	R & D	031992	LO	
BX15	R & D	031192	LO	
BX13	R & D	011692	LO	

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WAVETEK SAN DIEGO, CALIFORNIA

TITLE

PCB ASSY, SMT PARTS

SIZE	DWG. NO.	REV
D	1000-0458-0030	G

SCALE 2X SIZE	MODEL 2020/2030	SHEET 1 of 5

DRAWING NO. 1000-0458-01 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2000 SERIES	04/19/93	2 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB, MAIN	1000-0396-03	1	Effectivity date: 05/15/93
2				
3	CAP, CER, MOND, NPO, 10%, 4.7PF	906-0000-06S	0	*C13 *Note: DO NOT INSTALL AT THIS TIME
4				
5	CAP, CER, MOND, NPO, 10%, 10PF	901-011-02S	2	C52,53
6	CAP, CER, MOND, NPO, 10%, 22PF	909-002-21S	2	C33,34
7	CAP, CER NPO, 10%, 47PF	909-0470-00S	0	*C12
8	CAP, CER, MOND, NPO, 10%, 100PF	900-021-14S	1	C9
9	CAP, CER, MOND, NPO, 10%, 470PF	909-047-01S	1	C20 (C11 NOT USED)
10	CAP, CER, NPO, 10%, 50V, SMT, 1000PF	909-1000-00S	1	C21
11				
12	CAP, CER X7R, 10%, 4700 PF	909-047-02S	0	*C10 (NOT USED)
13				
14	CAP, .01 MFD 50V 10% MONOLITHIC CERAMIC X7R	900-021-01S	3	C2,C8,C22
15	CAP, SMD, CER, MOND, Z5U, 80/20/ .1UF	900-0210-15S	9	C26,C38,C39,C55,C56,C57,C37,C42,C43
16	CAP, CER, MOND, Z5U, 80/20, .22UF	900-0210-16S	6	C3-5,C7,C17,C29
17	CAP, CER, MOND, Z5U, 80/20, 1.0UF	909-0470-04S	2	C41,C35
18				
19				
20				
21	CAP, TANT, 10V, 10%, 10UF	916-010-10S	4	C6,C16,C27,C51
22	CAP, TANT, SMD, 10V, 10%, 22UF	916-022-10S	1	C30
23	CAP, TANT, 10V, 10%, 47	916-0470-10S	2	C18,C54
24				

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2000 SERIES	04/19/93	3 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
25	PCB TRACE	PCB TRACE	0	C14
26				
27				
28				
29	DIODE, SWITCHING, (1N914)	961-091-41S	16	CR1-7, CR9, CR11-16, CR19-20
30				
31	DIODE, ZENER, 6.2V 10%, 0.5W (1N753)	961-075-30S	1	ZR5
32	DIODE,ZENER, LOW LEAK, MIN=6.8V, MAX=13V	961-500-01S	3	ZR1-3 (DECREASE QTY TO 3 ON 6-1-93)
33	DIODE, REF, 1.235 V, +/-1%, SOB PACKAGE	961-3850-04S	1	VR1
34				
35				
36	RES, MF, 1/8w, 5%, SMT, 470 OHM	940-0470-00S	2	R50,R51
37	RES, SMD, 5%, 100 OHMS	940-010-01S	1	R61
38	RES, MF, 1/8W, 5%, 56 OHMS	920-356-28S	1	R18
39	RES, MF, 1/8W, 5% (1206) SMT 1K	924-4100-05S	4	R7,8,,R26,R27
40	RES, MF, 1/8W, 5%, 2.4K	924-4205-03S	1	R5
41	RES, MF, 1/8W, 1%, 6.04K	924-4600-03S	1	R14
42	RES, MF, 1/8W, 1%, 5.76K	924-4576-02S	1	R13
43	RES, MF, 1/8W, 5%, 10K	920-310-02S	1	R59
44	RES, SMD, MF, 1/8W, 5%, 100K	922-4100-03S	10	R19,R52, R54-58,R28,R29,R60
45				
46				
47				
48				
49	RES, MF, 1/8W, 5%, 470K	940-0470-04S	2	R21, R22

DRAWING TITLE		MODEL NO.		DATE	SHEET
PCB ASSY, SMD, 2000 SERIES		2000 SERIES		04/19/93	4 of 5
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS	
50	RES, MF, 1/8W, 1%, 845K	924-4845-04S	2	R10,11	
51	RES, MF, 1/8W, 5%, 1M	924-310-05S	5	R6,R20,R23,R53,R12	
52	RES, MF, 1/4W, 1%, 1M	924-310-06S	1	R9	
53	RES, MF, 1/8W, 1%, 604K	924-4604-03S	1	R25	
54	RES, MF, 10000000 OHM 1/8W,5%	920-410-06S	1	R62	
55					
56					
57					
58	RES. NTWK, GMR DIVIDER, THIN FILM	1000-0742-00	1	RN4	
59					
60	RES, POT, 1 TURN, 200	960-101-05S	1	TRM3	
61	RES, POT, 1 TURN, 500	960-101-06S	1	TRM4	
62	RES, POT, 1 TURN, 2K	960-101-07S	1	TRM2	
63	RES, POT, 1 TURN, 10K	960-101-04S	1	TRM1	
64	RES, POT, 1 TURN, 500K	960-101-08S	1	TRM5	
65					
66					
67					
68					
69	IC, A/D, HOLT	1000-0094-00	1	U1	
70	IC, LCD, C/DR, NEC UPD72256-00	965-5590-18S	1	U8	
71	MSM83C154V-6S OKI MICROCOMPUTER SPEC.	1000-0539-00	1	U7	
72	IC, OP AMP, TL062	965-617-01S	1	U5	
73	IC, RMS, CONV, AD737	965-6500-01S	1	U2	
74	IC, 14052 ANALOG MULTIPLEXER DUAL 4 CH	965-5870-93S	2	U6,U11	

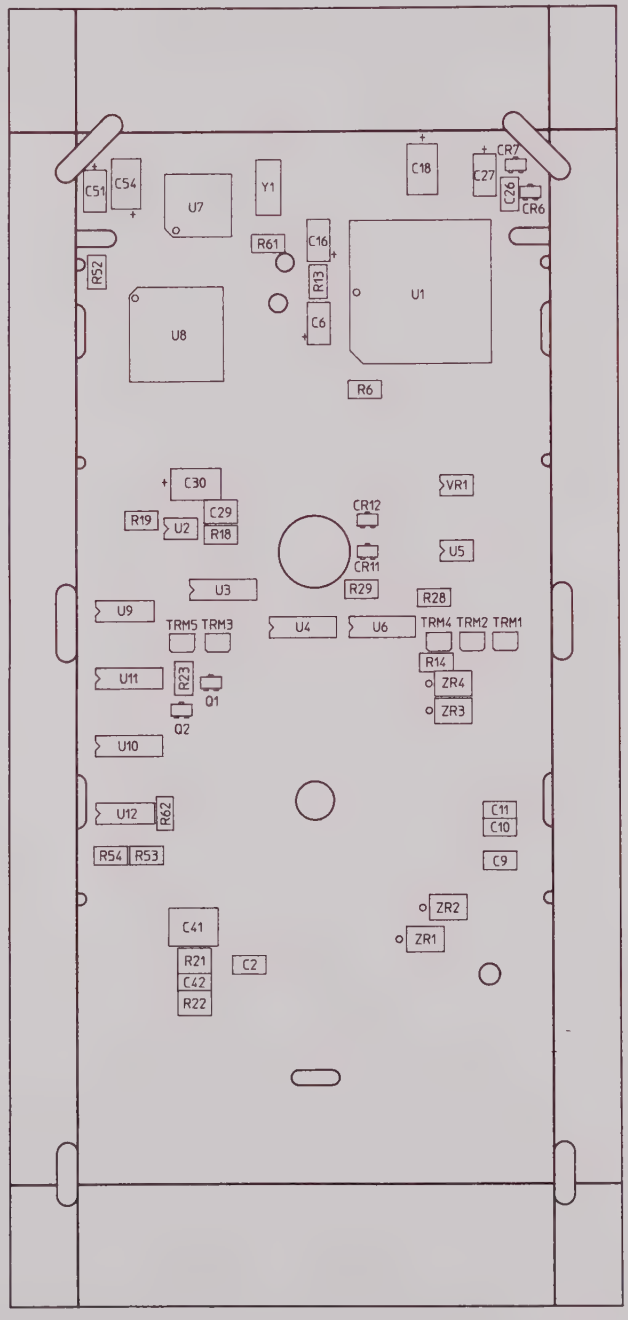
DRAWING NO. 1000-0458-01 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, SMD, 2000 SERIES	2000 SERIES	04/19/93	5 of 5

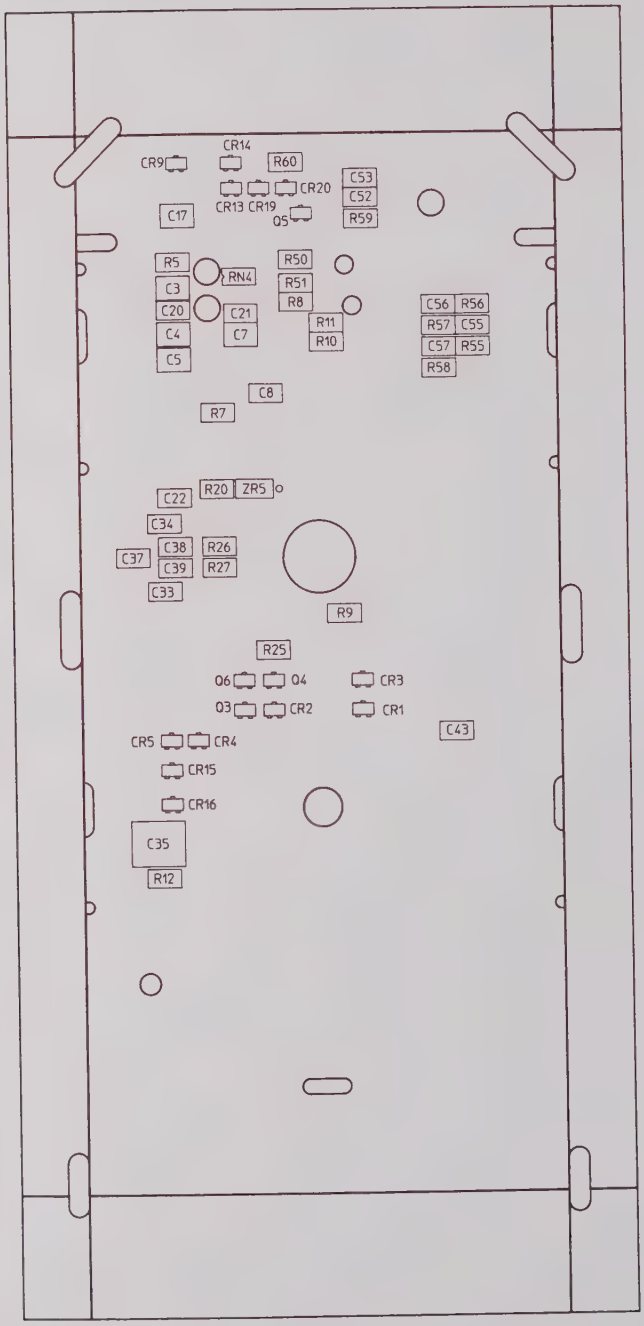
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
75	IC, 14053 ANALOG MULTIPLEXER TRIPLE 2 CH	965-5870-92S	2	U3,U4
76	IC, NAND, 74HC132	965-6351-36S	1	U9
77	IC, COUNTER, 74HC390	965-6351-40S	1	U10
78	IC, CD4069	965-587-05S	1	U12
79				
80				
81				
82	ZN7002, N CHANNEL ENHANCEMENT XSTR	963-100-51S	1	Q3
83	XSTR, PNP (2907) SOT 23	962-290-70S	1	Q5
84	XSTR, FET, 2N7002 N CHANNEL	963-100-50S	4	Q1,Q2,Q4,Q6
85	1 MHZ QUARTZ CRYSTAL MINI. LOW FREQUENCY LEAD-LESS	967-005-19S	1	Y1
86	DIODE, ZENER 5.6	961-523-22S	1	ZR4 (START DATE USAGE 6-1-93)

NOTES: UNLESS OTHERWISE SPECIFIED

1. THIS UNIT TO BE ASSEMBLED TO SPEC 000-1003.
2. COMPONENTS C12, C13, CR8, CR10, R35, & R63 ARE NOT INSTALLED ON THIS ASSEMBLY.



COMPONENT SIDE



SOLDER SIDE

REV	E.O. NO.	DATE	INC BY	APPVD
01G	2-12511	4-19-93	JJ	
01F	2-12769	1-15-93	JS	
01D	2-12755	11-12-92	JS	
01C	2-12704	072392	LO	LO.
01B	R & D	063092	LO	
008	R & D	060592	LO	
BX17	R & D	033092	LO	
BX16	R & D	031992	LO	
BX15	R & D	031192	LO	
BX13	R & D	011692	LO	

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CAGE CODE 23338

DR.	L.OFTEDAHL	011692
CHECK		
DESIGN		
ENG.		
APP'VD.		
APPVD.		

DO NOT SCALE DRAWING

WAVETEK SAN DIEGO · CALIFORNIA

TITLE

PCB ASSY, SMT PARTS

SIZE	DWG. NO.	REV
D	1000-0458-01	G

SCALE 2X SIZE | MODEL 2020/2030 | SHEET 1 of 5

DRAWING NO. 1000-0458-30 REV. 6

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN, SMD, 2030		04/19/93	2 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
1	PCB, MAIN	1000-0396-03	1	Effectivity date: 05/15/93
2				
3	CAP, CER, MONO, NPO, 10%, 4.7PF	906-0000-06S	0	*C13 *Note: DO NOT INSTALL AT THIS TIME
4				
5	CAP, CER, MONO, NPO, 10%, 10PF	901-011-02S	2	C52,53
6	CAP, CER, MONO, NPO, 10%, 22PF	909-002-21S	2	C33,34
7	CAP, CER NPO, 10%, 47PF	909-0470-00S	0	*C12
8	CAP, CER, MONO, NPO, 10%, 100PF	900-021-14S	1	C9
9	CAP, CER, MONO, NPO, 10%, 470PF	909-047-01S	1	C20 (C11 NOT USED)
10	CAP, CER, NPO, 10%, 50V, SMT, 1000PF	909-1000-00S	1	C21
11				
12	CAP, CER X7R, 10%, 4700 PF	909-047-02S	0	*C10 NOT USED
13				
14	CAP, .01 MFD 50V 10% MONOLITHIC CERAMIC X7R	900-021-01S	3	C2,C8,C22
15	CAP, SMD, CER, MONO, Z5U, 80/20/ .1UF	900-0210-15S	9	C26,C38,C39,C55,C56,C57,C37,C42,C43
16	CAP, CER, MONO, Z5U, 80/20, .22UF	900-0210-16S	6	C3-5,C7,C17,C29
17	CAP, CER, MONO, Z5U, 80/20, 1.0UF	909-0470-04S	2	C41,C35
18				
19				
20				
21	CAP, TANT, 10V, 10%, 10UF	916-010-10S	4	C6,C16,C27,C51
22	CAP, TANT, SMD, 10V, 10%, 22UF	916-022-10S	1	C30
23	CAP, TANT, 10V, 10%, 47	916-0470-10S	2	C18,C54
24				
25	PCB TRACE	PCB TRACE	0	C14

DRAWING TITLE	MODEL NO.	DATE	SHEET
PCB ASSY, MAIN, SMD, 2030		04/19/93	3 of 5

ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS
26				
27				
28				
29	DIODE, SWITCHING, (1N914)	961-091-41S	16	CR1-7, CR9, CR11-16, CR19-20
30				
31	DIODE, ZENER, 6.2V 10%, 0.5W (1N753)	961-075-30S	1	ZR5
32	DIODE,ZENER, LOW LEAK, MIN=6.8V, MAX=13V	961-500-01S	3	ZR1-3 (DECREASE QTY TO 3 ON 6-1-93)
33	DIODE, REF, 1.235 V, +/-1%, SO8 PACKAGE	961-3850-04S	1	VR1
34				
35				
36	RES, MF, 1/8w, 5%, SMT, 470 OHM	940-0470-00S	2	R50,R51
37	RES, SMD, 5%, 100 OHMS	940-010-01S	1	R61
38	RES, MF, 1/8W, 5%, 56 OHMS	920-356-28S	1	R18
39	RES, MF, 1/8W, 5% (1206) SMT 1K	924-4100-05S	4	R7,8,,R26,R27
40	RES, MF, 1/8W, 5%, 2.4K	924-4205-03S	1	R5
41	RES, MF, 1/8W, 1%, 6.04K	924-4600-03S	1	R14
42	RES, MF, 1/8W, 1%, 5.76K	924-4576-02S	1	R13
43	RES, MF, 1/8W, 5%, 10K	920-310-02S	1	R59
44	RES, SMD, MF, 1/8W, 5%, 100K	922-4100-03S	10	R19,R52, R54-58,R28,R29,R60
45				
46				
47				
48				
49	RES, MF, 1/8W, 5%, 470K	940-0470-04S	2	R21, R22
50	RES, MF, 1/8W, 1%, 845K	924-4845-04S	2	R10,11

DRAWING NO. 1000-0458-30 REV. G

DRAWING TITLE		MODEL NO.		DATE	SHEET
PCB ASSY, MAIN, SMD, 2030				04/19/93	4 of 5
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS	
51	RES, MF, 1/8W, 5%, 1M	924-310-05S	5	R6,R20,R23,R53,R12	
52	RES, MF, 1/4W, 1%, 1M	924-310-06S	1	R9	
53	RES, MF, 1/8W, 1%, 604K	924-4604-03S	1	R25	
54	RES, MF, 10000000 OHM 1/8W,5%	920-410-06S	1	R62	
55					
56					
57					
58	RES. NTWK, GMR DIVIDER, THIN FILM	1000-0742-00	1	RN4	
59					
60	RES, POT, 1 TURN, 200	960-101-05S	1	TRM3	
61	RES, POT, 1 TURN, 500	960-101-06S	1	TRM4	
62	RES, POT, 1 TURN, 2K	960-101-07S	1	TRM2	
63	RES, POT, 1 TURN, 10K	960-101-04S	1	TRM1	
64	RES, POT, 1 TURN, 500K	960-101-08S	1	TRM5	
65					
66					
67					
68					
69	IC, A/D, HOLT	1000-0094-00	1	U1	
70	IC, LCD, C/DR, NEC UPD72256-00	965-5590-18S	1	U8	
71	MSM83C154Y-6S OKI MICROCOMPUTER SPEC.	1000-0539-00	1	U7	
72	IC, OP-AMP, LT1112S8	965-6170-07S	1	U5	
73	IC, RMS, CONV, AD737	965-6500-01S	1	U2	
74	IC, 14052 ANALOG MULTIPLEXER DUAL 4 CH	965-5870-93S	2	U6,U11	
75	IC, 14053 ANALOG MULTIPLEXER TRIPLE 2 CH	965-5870-92S	2	U3,U4	

DRAWING TITLE		MODEL NO.		DATE	SHEET
PCB ASSY, MAIN, SMD, 2030				04/19/93	5 of 5
ITEM	DRAWING TITLE	DRAWING NO.	REQ.	REMARKS	
76	IC, NAND, 74HC132	965-6351-36S	1	U9	
77	IC, COUNTER, 74HC390	965-6351-40S	1	U10	
78	IC, CD4069	965-587-05S	1	U12	
79					
80					
81					
82	ZN7002, N CHANNEL ENHANCEMENT XSTR	963-100-51S	1	Q3	
83	XSTR, PNP (2907) SOT 23	962-290-70S	1	Q5	
84	XSTR, FET, 2N7002 N CHANNEL	963-100-50S	4	Q1,Q2,Q4,Q6	
85	1 MHZ QUARTZ CRYSTAL MINI. LOW FREQUENCY LEAD-LESS	967-005-19S	1	Y1	
86	DIODE, ZENER 5.6	961-523-22S	1	ZR4 (START DATE USAGE 6-1-93)	

4 | 3

NOTES: UNLESS OTHERWISE SPECIFIED

1. See Doc. # 1000-0201-00 for manufacturing specs.

2. For graphics display see

   Artwork # 1000-0739-00 for PCI ------- (A) dimensions
   # 1000-0740-00 for Crystaliod -------- (B) dimensions.

3. T "ON" or T "OFF" between 10% and 90%.

4. Backplane to Backplane, Selectline to Selectline, Backplane to Selectline.

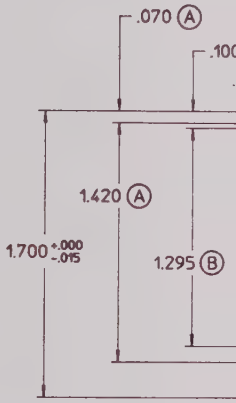
5. Contrast Ratio:
   non-selected segment (RMS DRIVE = 0.25 vop typ.)
   selected segment (RMS DRIVE = 0.56 vop typ.)
   Viewing at THETA = 25°, PHI = 0° .

6. Viewing face polarizer to extend to glass edge +.000 -.025.
   Rear face polarizer to extend to cover at least 50% of seal width.

7. Port plug is left side, centered on small glass with max length .400 x height .050.

MULTIPLEX SCHEME

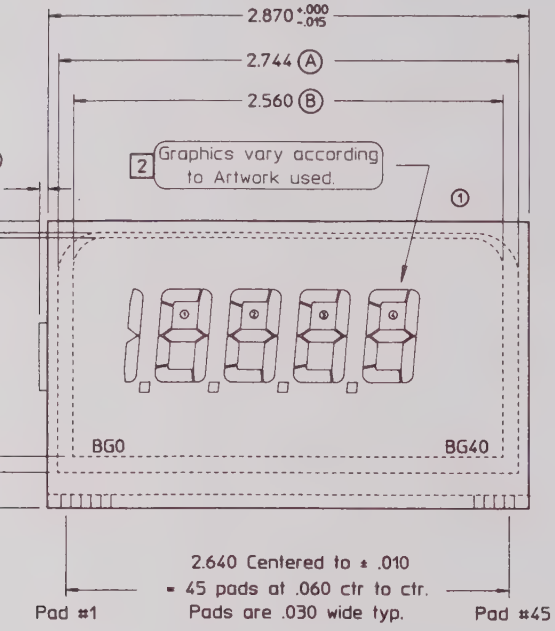
PAD	BP1	BP2	BP3	BP4
1				BP4
2		BP2		
3			BP3	
4	BP1			
5				PK
6	MX	MN	-	AV
7	HLD	REL		
8	√HLD	√REL	√M/M	√PK
9	2F	2G	2E	2D
10	1F	1G	1E	1D
11	BAT	BOLT	LOGIC	
12	PLUS	MINUS	1	1DP
13	1A	1B	1C	10DP
14	2A	2B	2C	100DP
15	3A	3B	3C	1000DP
16	XXXX	XXXX	XXXX	0-10
17	XXXX	XXXX	XXXX	SCALE
18	BG3	BG2	BG1	BG0
19	BG4	BG5	BG6	BG7
20	BG11	BG10	BG9	BG8
21	BG12	BG13	BG14	BG15
22	BG19	BG18	BG17	BG16
23	XXXX	XXXX	XXXX	XXXX
24	XXXX	XXXX	XXXX	XXXX
25	XXXX	XXXX	XXXX	XXXX
26	BG20	BG21	BG22	BG23
27	BG27	BG26	BG25	BG24
28	BG28	BG29	BG30	BG31
29	BG35	BG34	BG33	BG32
30	BG36	BG37	BG38	BG39
31		BP2		
32			BP3	
33				BP4
34				BG40
35	n	u	m	F
36	k	M	OHM	Hz
37	u	m	V	A
38	AC	%	DC	XXXX
39	4A	4B	4C	
40	4F	4G	4E	4D
41	3F	3G	3E	3D
42	√RNG	√BEEP		
43	RNG	BEEP		
44		BP2		
45	BP1			

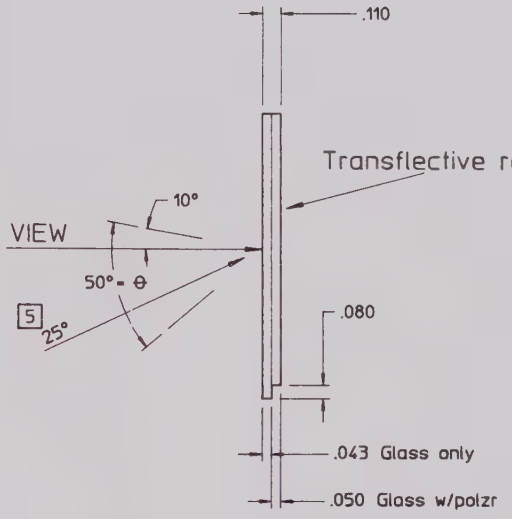


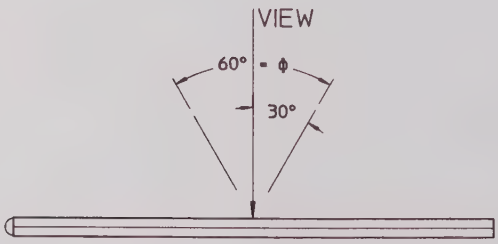
MAXIMUM RATINGS		
PARAMETER	VALUE	UNITS
Applied voltage	10	VRMS
DC offset	25	MVDS
Operating temp.	-20 to +55	°C
Storage temp.	-30 to +85	°C

ELECTRICAL / OPTICAL PARAMETERS					
PARAMETER	VALUE MIN	VALUE TYP	VALUE MAX	UNITS	CONDITIONS
Operating voltage (Vop)		3.1	5.5	Vdc	+25°C
Operating voltage T.C.		TBD		%Vop/°C	-20°Cto+55°C
Frame frequency	60	100	200	Hz	
Optical ON time (3)			200	msec	+25°C
Optical OFF time (3)			200	msec	+25°C
Optical ON time (3)			500	msec	-20°C
Optical OFF time (3)			500	msec	-20°C
Contrast ratio [5]	4				+25°C
DC resistance (4)		100		mohms	+25°C
Viewing angles	THETA= +10° to -40°, PHI= ±30°				

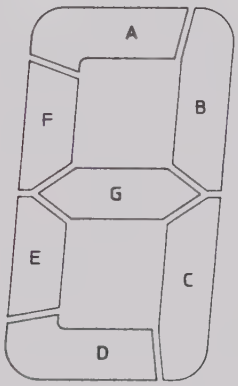
SPACE FOR GRAP
WHEN AVAILA



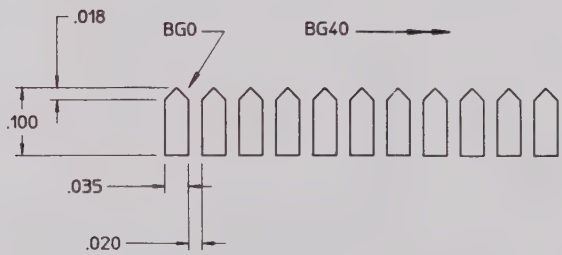




LCD detail
Scale 2X



Character detail
Scale 8X



Bar-graph detail
Scale 8X

HICS REPRO
BLE

REV	E O NO	DATE	INC BY	APPVD
B	2-12704	5-29-92		
BX2	PCI&CRYS	2/19/92	G.Elder	

UNLESS OTHERWISE SPECIFIED		DR. G.Elder	2/18/92
TOLERANCES		CHECK	
DECIMALS	ANGLES	DESIGN G.Elder	2/18/92
.X ±	±0°30'	ENG G.Elder	2/18/92
.XX ±		APPVD	
XXX ± .005		APPVD	
DRILL HOLE DIA .013 THRU .125 +.003 -.001 .126 THRU .230 +.005 -.001 .231 AND OVER +.006-.001		DO NOT SCALE DRAWING	
REMOVE ALL BURRS AND SHARP EDGES			

WAVETEK SAN DIEGO · CALIFORNIA

TITLE LCD (PCI and CRYSTALOID)

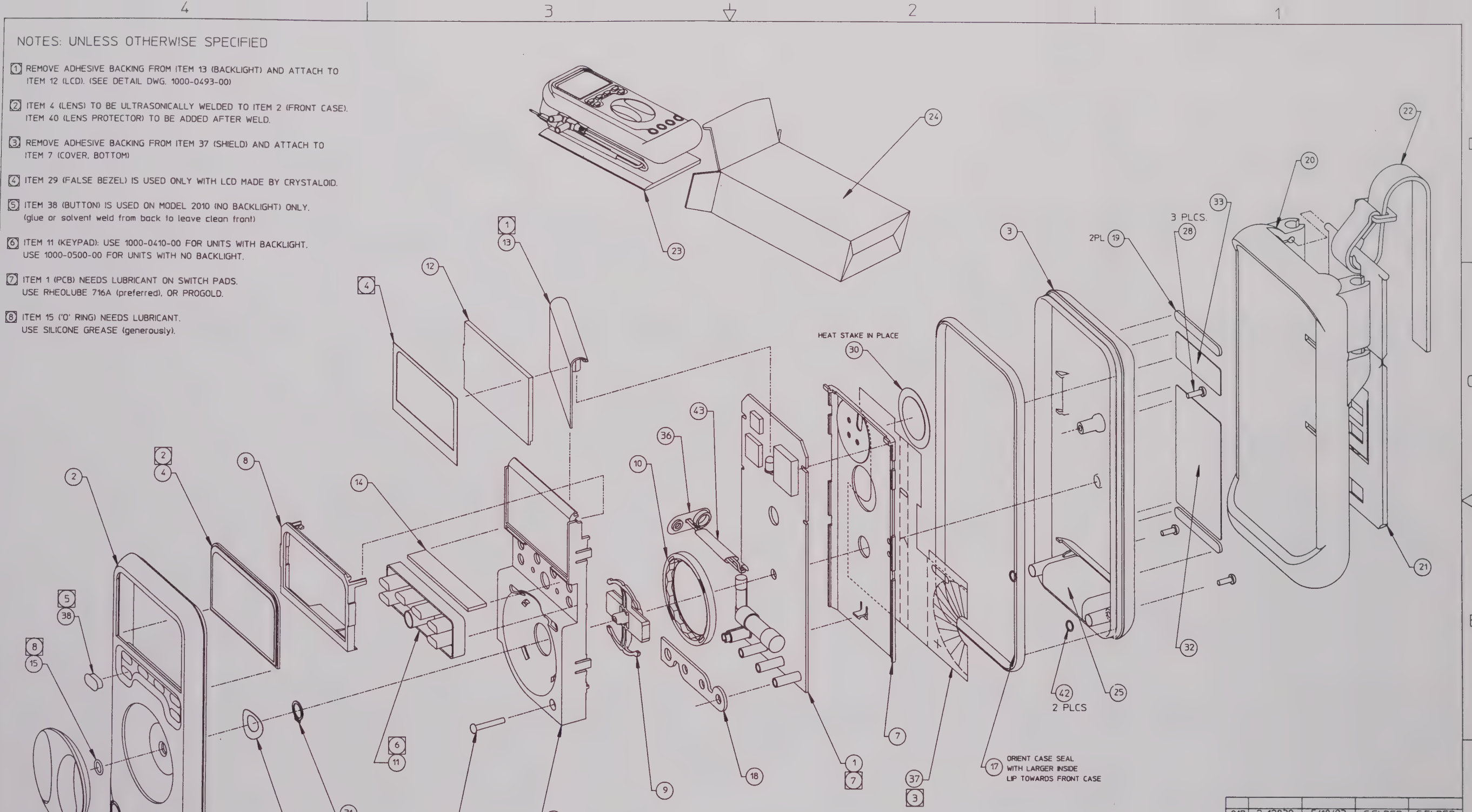
CAGE CODE 23338

SIZE	DWG. NO	REV
D	1000-0193-00	B

SCALE	2/1	MODEL	2020	SHEET	1 of 1

NOTES: UNLESS OTHERWISE SPECIFIED

1. REMOVE ADHESIVE BACKING FROM ITEM 13 (BACKLIGHT) AND ATTACH TO ITEM 12 (LCD). (SEE DETAIL DWG. 1000-0493-00)
2. ITEM 4 (LENS) TO BE ULTRASONICALLY WELDED TO ITEM 2 (FRONT CASE). ITEM 40 (LENS PROTECTOR) TO BE ADDED AFTER WELD.
3. REMOVE ADHESIVE BACKING FROM ITEM 37 (SHIELD) AND ATTACH TO ITEM 7 (COVER, BOTTOM)
4. ITEM 29 (FALSE BEZEL) IS USED ONLY WITH LCD MADE BY CRYSTALOID.
5. ITEM 38 (BUTTON) IS USED ON MODEL 2010 (NO BACKLIGHT) ONLY. (glue or solvent weld from back to leave clean front)
6. ITEM 11 (KEYPAD): USE 1000-0410-00 FOR UNITS WITH BACKLIGHT. USE 1000-0500-00 FOR UNITS WITH NO BACKLIGHT.
7. ITEM 1 (PCB) NEEDS LUBRICANT ON SWITCH PADS. USE RHEOLUBE 716A (preferred), OR PROGOLD.
8. ITEM 15 ('O' RING) NEEDS LUBRICANT. USE SILICONE GREASE (generously).



SEE SEPARATE PART LISTS

1000-0751-XX	2010
1000-0457-XX	2020
1000-0752-XX	2030
PARTS LIST TOP ASSEMBLY	MODEL NO.

UNLESS OTHERWISE SPECIFIED
TOLERANCES
DECIMALS: .X ±, .XX ±, .XXX ± — ANGLES: ±0°30'
DRILL HOLE DIA.
.013 THRU .125 +.003 -.001
.126 THRU .230 +.005 -.001
.231 AND OVER +.006-.001
REMOVE ALL BURRS AND SHARP EDGES

DR.	G.ELDER	5/18/93
CHECK		
DESIGN		
ENG.	G.ELDER	5/18/93
APPVD.		
APPVD.		

DO NOT SCALE DRAWING

REV	E.O. NO.	DATE	INC BY	APPVD
01B	2-12839	5/18/93	G.ELDER	G.ELDER
B	2-12704	7/9/92	JC	

WAVETEK

TITLE: PICTORIAL, T/A 2000 SERIES

SIZE D | DWG. NO. 1000-0504-01

SCALE NONE | MODEL 20X0 | SHEET 1 OF 1

PARENT ITEM NO. 1000-0751-01
DESCRIPTION T/A 2010E IEC APPROVED
ENGR DRAW 1000-0751-01 C
STANDARD BATCH QUANTITY 1.000
ITEM TYPE 1 LOW LEVEL 00
UNIT MEAS EA PLANNER

LL CD	SEQ NO.	COMPONENT ITEM NO.	DESCRIPTION	ENGINEERING DRAWING NUMBER		QUANTITY PER	ITEM UM	TYP	OPT NO.	FIRST OP SEQ	LT ADJ	EFFECTIVE DATES FROM	TO
01		1000-0504-01	PICTORIAL, T/A, 2000 SERIES	1000-0504-01	B	.000	EA	0					
02		1000-0909-00	CALIBRATION PROCEDURE 2010	1000-0909-00	B	1.000	EA	0					
01	0001	1000-0394-11	PCB ASSY, MAIN, THRU HOLE 2010	1000-0394-11	C	1.000	EA	1					
02	0002	1000-0714-02	PAD PRINT, CASE	1000-0714-02	B	1.000	EA	2					
02	0003	1000-0384-00	CASE, REAR - 2000 SERIES	1000-0384-00	B	1.000	EA	4					
02	0004	1000-0422-00	LENS, FRONT CASE - 2000 SERIES	1000-0422-00	B	1.000	EA	4					
02	0006	1000-0408-01	COVER, TOP-2000 SERIES	1000-0408-01	B	1.000	EA	4					
02	0007	1000-0409-01	COVER, BOTTOM-2000 SERIES	1000-0409-01	B	1.000	EA	4					
02	0008	1000-0431-00	BEZEL - 2000 SERIES	1000-0431-00	B	1.000	EA	4					
02	0009	1000-0463-00	ROTOR ASSY	1000-0463-00	B	1.000	EA	2					
02	0010	1000-0432-00	CAM RING - 2000 SERIES	1000-0432-00	B	1.000	EA	4					
02	0011	1000-0500-00	KEY PAD, BUTTON ARRAY	1000-0500-00	C	1.000	EA	0					
02	0012	1000-0193-00	LCD, PHOENIX	1000-0193-00	B	1.000	EA	4					
02	0014	1000-0449-00	CONNECTOR, ZEBRA	1000-0449-00	B	1.000	EA	4					
02	0015	991-0201-27	"O"RING .375X.046	ISM		1.000	EA	4					
02	0016	982-440-078	SCREW,4-40X7/8 FH PHILLIPS 82	ISM		1.000	EA	4					
02	0017	1000-0411-00	SEAL, CASE - 2000 SERIES	1000-0411-00	B	1.000	EA	4					1/01/94
02	0017	1000-0411-03	SEAL, CASE - 2000 SERIES	1000-0411-03	B	1.000	EA	4				1/02/94	
01	0018	1000-0412-01	SEAL, INPUT JACKS-2000 SERIES	1000-0412-01	B	1.000	EA	4					
02	0019	3000-450-244	PAD,ANTI-SKID	3000-450-244	A	2.000	EA	4					
02	0020	1000-0453-00	HOLSTER, GREY, 2000 SERIES	1000-0453-00	D	1.000	EA	4					
02	0021	1000-0454-01	BAIL, HOLSTER-2000 SERIES	1000-0454-01	B	1.000	EA	4					
02	0022	1000-0513-00	FLEX STRAP ASSY	1000-0513-00	B	1.000	EA	4					
02	0023	1000-0455-01	MANUAL, OPERATORS 2010	1000-0455-01	B	1.000	EA	4					
02	0024	1000-0456-01	CARTON, 2010	1000-0456-01	B	1.000	EA	4					
07	0025	975-1000-22	BATTERY, 9-VOLT ALKALINE	ISM		1.000	EA	4					
02	0028	980-4401-62	SCREW, PHP 4-40-5/8 SS BK OXID	ISM		3.000	EA	4					
02	0030	994-0030-02	BEEPER DISK, PIEZO 35MM	ISM		1.000	EA	4					
02	0031	973-0101-88	RETAINING RING, EXTERNAL	ISM		1.000	EA	4					
01	0032	1000-0468-01	LABEL, WARNING	1000-0468-01	B	1.000	EA	4					
02	0033	1000-0732-01	LABEL, CO.NAME	1000-0732-01	B	1.000	EA	4					
02	0034	986-8000-22	WASHER, SPRING .378X.658X.005	ISM		1.000	EA	4					
04	0036	3000-451-182	PAD,BATTERY CONN. HD	3000-45X-182	A	1.000	EA	4					
02	0037	1000-0803-01	SHIELD 2000 SERIES	1000-0803-01	B	1.000	EA	4					
02	0038	1000-0566-00	BUTTON	1000-0566-00	B	1.000	EA	4					
02	0039	1000-0839-00	PAD PRINTING, KNOB	1000-0839-00	X	1.000	EA	2					
02	0040	1000-0886-00	WINDOW PROTECTOR	1000-0886-00	B	1.000	EA	4					
01	0042	991-0201-29	O-RING .214 X .047	ISM		2.000	EA	4					
01	0043	979-110-01	SLEEVE, BATTERY WIRE	ISM		1.000	EA	4					

PARENT ITEM NO. 1000-0457-02
DESCRIPTION T/A 2020E IEC APPROVED
ENGR DRAW 1000-0457-02 C
STANDARD BATCH QUANTITY 1.000
ITEM TYPE 1 LOW LEVEL 00
UNIT MEAS EA PLANNER

LL CD	SEQ NO.	COMPONENT ITEM NO.	DESCRIPTION	ENGINEERING DRAWING NUMBER		QUANTITY PER	ITEM UM	TYP	OPT NO.	FIRST OP SEQ	LT ADJ	EFFECTIVE DATES FROM	TO
01		1000-0504-01	PICTORIAL, T/A, 2000 SERIES	1000-0504-01	B	.000	EA	0					
02		1000-0798-00	TRIM PROCEDURE/CALIB.2020/2030	1000-0798-00	B	.000	EA	0					
01	0001	1000-0394-02	PCB ASSY, MAIN, THRU HOLE,2020	1000-0394-02	B	1.000	EA	1					
02	0002	1000-0757-02	PAD, PRINT, CASE	1000-0757-02	B	1.000	EA	2					
02	0003	1000-0384-00	CASE, REAR - 2000 SERIES	1000-0384-00	B	1.000	EA	4					
02	0004	1000-0422-00	LENS, FRONT CASE - 2000 SERIES	1000-0422-00	B	1.000	EA	4					
02	0006	1000-0408-01	COVER, TOP-2000 SERIES	1000-0408-01	B	1.000	EA	4					
02	0007	1000-0409-01	COVER, BOTTOM-2000 SERIES	1000-0409-01	B	1.000	EA	4					
02	0008	1000-0431-00	BEZEL - 2000 SERIES	1000-0431-00	B	1.000	EA	4					
02	0009	1000-0463-00	ROTOR ASSY	1000-0463-00	B	1.000	EA	2					
02	0010	1000-0432-00	CAM RING - 2000 SERIES	1000-0432-00	B	1.000	EA	4					
03	0011	1000-0410-01	KEY PAD, BUTTON ARRAY	1000-0410-01	B	1.000	EA	4					
02	0012	1000-0193-00	LCD, PHOENIX	1000-0193-00	B	1.000	EA	4					
02	0013	1000-0448-00	BACKLIGHT - 2000 SERIES	1000-0448-00	B	1.000	EA	4					
02	0014	1000-0449-00	CONNECTOR, ZEBRA	1000-0449-00	B	1.000	EA	4					
02	0015	991-0201-27	"O"RING .375X.046	ISM		1.000	EA	4					
02	0015	982-440-078	SCREW,4-40X7/8 FH PHILLIPS 82	ISM		1.000	EA	4					
02	0017	1000-0411-00	SEAL, CASE - 2000 SERIES	1000-0411-00	B	1.000	EA	4					1/01/94
02	0017	1000-0411-03	SEAL, CASE - 2000 SERIES	1000-0411-03	B	1.000	EA	4				1/01/94	
01	0018	1000-0412-01	SEAL, INPUT JACKS-2000 SERIES	1000-0412-01	B	1.000	EA	4					
02	0019	3000-450-244	PAD,ANTI-SKID	3000-450-244	A	2.000	EA	4					
02	0020	1000-0453-00	HOLSTER, GREY, 2000 SERIES	1000-0453-00	D	1.000	EA	4					
02	0021	1000-0454-01	BAIL, HOLSTER-2000 SERIES	1000-0454-01	B	1.000	EA	4					
02	0022	1000-0513-00	FLEX STRAP ASSY	1000-0513-00	B	1.000	EA	4					
02	0023	1000-0455-01	MANUAL, OPERATORS 2010	1000-0455-01	B	1.000	EA	4					
02	0024	1000-0456-01	CARTON, 2010	1000-0456-01	B	1.000	EA	4					
07	0025	975-1000-22	BATTERY, 9-VOLT ALKALINE	ISM		1.000	EA	4					
02	0028	980-4401-62	SCREW, PHP 4-40-5/8 SS BK OXID	ISM		3.000	EA	4					
02	0030	994-0030-02	BEEPER DISK, PIEZO 35MM	ISM		1.000	EA	4					
02	0031	973-0101-88	RETAINING RING, EXTERNAL	ISM		1.000	EA	4					
01	0032	1000-0468-01	LABEL, WARNING	1000-0468-01	B	1.000	EA	4					
02	0033	1000-0732-01	LABEL, CO.NAME	1000-0732-01	B	1.000	EA	4					
02	0034	986-8000-22	WASHER, SPRING .378X.658X.005	ISM		1.000	EA	4					
04	0036	3000-451-182	PAD,BATTERY CONN. HD	3000-45X-182	A	1.000	EA	4					
02	0037	1000-0803-01	SHIELD 2000 SERIES	1000-0803-01	B	1.000	EA	4					
02	0039	1000-0839-00	PAD PRINTING, KNOB	1000-0839-00	X	1.000	EA	2					
02	0040	1000-0886-00	WINDOW PROTECTOR	1000-0886-00	B	1.000	EA	4					
01	0042	991-0201-29	O-RING .214 X .047	ISM		2.000	EA	4					
01	0043	979-110-01	SLEEVE, BATTERY WIRE	ISM		1.000	EA	4					

PARENT ITEM NO. 1000-0752-01
DESCRIPTION T/A 2030E IEC APPROVED
ENGR DRAW 1000-0752-01 C
STANDARD BATCH QUANTITY 1.000
ITEM TYPE 1 LOW LEVEL 00
UNIT MEAS EA PLANNER

LL CD	SEQ NO.	COMPONENT ITEM NO.	DESCRIPTION	ENGINEERING DRAWING NUMBER		QUANTITY PER	ITEM UM	TYP	OPT NO.	FIRST OP SEQ	LT ADJ	EFFECTIVE DATES FROM	TO
01		1000-0504-01	PICTORIAL, T/A, 2000 SERIES	1000-0504-01	B	.000	EA	0					
02		1000-0798-00	TRIM PROCEDURE/CALIB.2020/2030	1000-0798-00	B	.000	EA	0					
01	0001	1000-0394-31	PCB ASSY, MAIN THRU HOLE 2030	1000-0394-31	B	1.000	EA	1					
02	0002	1000-0767-02	PAD PRINT, CASE 2030	1000-0767-02	B	1.000	EA	2					
02	0003	1000-0384-00	CASE, REAR - 2000 SERIES	1000-0384-00	B	1.000	EA	4					
02	0004	1000-0422-00	LENS, FRONT CASE - 2000 SERIES	1000-0422-00	B	1.000	EA	4					
02	0006	1000-0408-01	COVER, TOP-2000 SERIES	1000-0408-01	B	1.000	EA	4					
02	0007	1000-0409-01	COVER, BOTTOM-2000 SERIES	1000-0409-01	B	1.000	EA	4					
02	0008	1000-0431-00	BEZEL - 2000 SERIES	1000-0431-00	B	1.000	EA	4					
02	0009	1000-0463-00	ROTOR ASSY	1000-0463-00	B	1.000	EA	2					
02	0010	1000-0432-00	CAM RING - 2000 SERIES	1000-0432-00	B	1.000	EA	4					
03	0011	1000-0410-01	KEY PAD, BUTTON ARRAY	1000-0410-01	B	1.000	EA	4					
02	0012	1000-0193-00	LCD, PHOENIX	1000-0193-00	B	1.000	EA	4					
02	0013	1000-0448-00	BACKLIGHT - 2000 SERIES	1000-0448-00	B	1.000	EA	4					
02	0014	1000-0449-00	CONNECTOR, ZEBRA	1000-0449-00	B	1.000	EA	4					
02	0015	991-0201-27	"O"RING .375X.046	ISM		1.000	EA	4					
02	0016	982-440-078	SCREW,4-40X7/8 FH PHILLIPS 82	ISM		1.000	EA	4					
02	0017	1000-0411-00	SEAL, CASE - 2000 SERIES	1000-0411-00	B	1.000	EA	4					1/01/94
02	0017	1000-0411-03	SEAL, CASE - 2000 SERIES	1000-0411-03	B	1.000	EA	4				1/02/94	
01	0018	1000-0412-01	SEAL, INPUT JACKS-2000 SERIES	1000-0412-01	B	1.000	EA	4					
02	0019	3000-450-244	PAD,ANTI-SKID	3000-450-244	A	2.000	EA	4					
02	0020	1000-0453-00	HOLSTER, GREY, 2000 SERIES	1000-0453-00	D	1.000	EA	4					
02	0021	1000-0454-01	BAIL, HOLSTER-2000 SERIES	1000-0454-01	B	1.000	EA	4					
02	0022	1000-0513-00	FLEX STRAP ASSY	1000-0513-00	B	1.000	EA	4					
02	0023	1000-0455-01	MANUAL, OPERATORS 2010	1000-0455-01	B	1.000	EA	4					
02	0024	1000-0456-01	CARTON, 2010	1000-0456-01	B	1.000	EA	4					
07	0025	975-1000-22	BATTERY, 9-VOLT ALKALINE	ISM		1.000	EA	4					
02	0028	980-4401-62	SCREW, PHP 4-40-5/8 SS BK OXID	ISM		3.000	EA	4					
02	0030	994-0030-02	BEEPER DISK, PIEZO 35MM	ISM		1.000	EA	4					
02	0031	975-0101-88	RETAINING RING, EXTERNAL	ISM		1.000	EA	4					
01	0032	1000-0468-01	LABEL, WARNING	1000-0468-01	B	1.000	EA	4					
02	0033	1000-0732-01	LABEL, CO.NAME	1000-0732-01	B	1.000	EA	4					
02	0034	986-8000-22	WASHER, SPRING .378X.658X.005	ISM		1.000	EA	4					
04	0036	3000-451-182	PAD,BATTERY CONN. HD	3000-45X-182	A	1.000	EA	4					
02	0037	1000-0803-01	SHIELD 2000 SERIES	1000-0803-01	B	1.000	EA	4					
02	0039	1000-0839-00	PAD PRINTING, KNOB	1000-0839-00	X	1.000	EA	2					
02	0040	1000-0886-00	WINDOW PROTECTOR	1000-0886-00	B	1.000	EA	4					
01	0042	991-0201-29	O-RING .214 X .047	ISM		2.000	EA	4					
01	0043	979-110-01	SLEEVE, BATTERY WIRE	ISM		1.000	EA	4					

Factory Service

Read the warranty located at the front of this manual before requesting warranty or non-warranty repairs.

Shipping Instructions

For in- and out-of-warranty repairs in the United States, we recommend shipping your *Wavetek product* to the factory for repair. Our factory service center features 24-hour turnaround time under normal circumstances, with a maximum of 48 hours guaranteed. Combined with low flat rate charges and fast turnaround time, the factory service center provides your best overall service alternative. (If you wish to utilize a local service facility, a list of authorized service centers in the United States can be found on the following pages.) A *Wavetek product*, returned for calibration or repair, should be shipped with the following: your company name (if applicable), your name, address, telephone number, proof of purchase (for warranty repairs), and any test leads used with the meter. In addition, make sure to **include a written description of the problem encountered or service required. For minimum turn-around time on out-of-warranty repairs please phone in advance for service-charge rates. Ship the *product* in original packaging or a sturdy box to the following address and marked *Attention: Instrument Repair/Service*:**

For U.S.A.:
Wavetek
Instruments Division
9045 Balboa Ave.
San Diego, CA 92123
Tel: (619) 279-2200 ext. 670
800-223-9885
Fax: (619) 495-3296

For U.K.:
Wavetek
Datron Division
Hurricane Way
Norwich, NR6 6JB, U.K.
Tel: 011-44-603-404824 U.K.
Fax: 011-44-603-483670 U.K.

For Canada:
(Refer to Service
Centers-Canada
on the following pages.)

The *product* will be returned with the shipping charge paid by Wavetek Corp. For questions in North America, contact the Instrument Repair & Service Department at (619) 279-2200 ext. 670. See above listing for factory service center address. If local service is necessary, the centers on the following pages are authorized to repair Wavetek Corp. Instruments.

Service and Shipping Instructions for Other Countries

Contact your local Wavetek Corp. dealer or distributor where the *product* was purchased or refer to the *Service Centers - Other* list on the following pages.
Please note that authorized service centers are ***not required*** to abide by the factory flat fee policy. Please contact individual centers for estimates.

Service Centers – U.S.A.

Alabama

Arnolds Instrumentation
3258 Spring Hill Road
Mobile, AL 36607
(205) 478-3230

California

Wavetek
Instruments Division
9045 Balboa Ave.
San Diego, CA 92123
(619) 279-2200
800-223-9885
Fax: (619) 565-7942

Standard Meter Labs
236 Rickenbacher Circle
Livermore, CA 94550
(415) 449-0220

Colorado

Instrument Repair Labs
2100 W. 6th Avenue #A
Broomfield, CO 80020
(303) 469-5375

R&R Instruments
15701 E. 1st Ave., Unit 106
Aurora, CO 80011
(303)364-8325

Georgia

Peach State Instruments
869-1 Pickens Industrial Drive
Marietta, GA 30062
(404) 424-0447

Illinois

Metermaster, Inc.
2055 Army Trail Rd., Suite 134
Addison, IL 60101
(708) 268-8100

Indiana

Electro Lab Services
1302 N. Fulton Avenue
Evansville, IN 47712
(812) 423-5211

Louisiana

Industrial Instrument Works
5745 Salmen Avenue
Harahan, LA 70123
(504) 733-8355

Maryland

EIL Instruments
10 Loveton Circle
Sparks, MD 21152
(301) 771-4800

Massachusetts

Cal-Tek
20 Republic Road
N. Billerica, MA 01862
(508) 667-8541

EIL Instruments
21 'A' Street
Burlington, MA 01803
(617) 272-9450

Minnesota

Instrumentation Services
957 Winnetka Avenue North
Minneapolis, MN 55427
(612) 544-8916

Missouri

Industrial Service Labs
1530 Page Industrial Blvd.
St. Louis, MO 63132
(314) 423-3141

New York

EIC Electronics
85 Avenue East
Rochester, NY 14621
(716) 544-4392

EIL Instruments
9020 Wehrle Drive
Clarence, NY 14031
(716) 634-8500

Instrument Mart
295 Community Drive
Great Neck, NY 11021
(516) 487-7430

Oklahoma

Central Instrument Labs
3158 S. 108th E. Avenue
Tulsa, OK 74146
(918) 622-0114

Ohio

Unitek
865 Cleveland Avenue
Columbus, OH 43201
(614) 291-9909

Oregon

Westcon, Inc.
5101 N. Interstate Avenue
Portland, OR 97217
(503) 283-0132

Pennsylvania

EIL Instruments, Inc.
701 Rodi Road
Pittsburgh, PA 15235
(412) 823-2255

Sunshine Instruments, Inc.
1810 Grant Avenue
Philadelphia, PA 19115
(215) 673-5600

Texas

EIL Instruments
7385 Ashcroft Street
Houston, TX 77081
(713) 271-3100

Metermaster, Inc.
3405 Express Drive
Garland, TX 75041
(214) 271-5671

Meters & Instruments
6428 Gulf Freeway
Houston, TX 77023
(713) 644-1631

Washington

EIL Instruments
2883 152nd Avenue NE
Redmond, WA 98052
(206) 882-3222

Service Centers – Canada

Alberta

Kingsway Aviation
4238 91 'A' Street
Edmonton T6E 5V2
(403) 463-5264

British Columbia

Miller Instruments
3871 N. Fraser Way, Unit 1
Burnaby V5J 5G6
(604) 431-8882

Manitoba

Probe Industrial Electronics
1874 Portage Avenue
Winnipeg R3J 0H2
(204) 885-9320

Ontario

BCS Electronics
855 Matheson Blvd E, Unit 6
Mississauga L4W 4L6
(416) 602-8550

Quebec

Projean Ltd.
1332 Rue Belanger East
Montreal H2G 1A1
(514) 273-8331

Primo Instruments
11235 Boul. L'Archeveque
Montreal-Nord H1H 3A8
(514) 329-3242

Service Centers – Other

Angola

Technidata Ltd.
P.O. Box 1619
Rua Reverendo Agostinho Pedro
Neto 21-21A
LUANDA
Tel: 32025/32309 Tlx: 3019

Argentina

Reycom Electronica SRL
Uruguay 362 Peso 8-Depto. F
1015 BUENOS AIRES

Australia

Warburton Franki
32 Parramatta Road
LIDCOMBE, NSW2141
Tel: 61-02-648-5455
Fax: 61-02-647-1545

Austria

LICO - GmbH
Felbigergasse 38
A-1140 WIEN
Tel: 0222-940621 Tlx: 133378
Fax: 0222-944174

Bahrain

Al-Jishi Corporation
P.O. Box 617
Al-Khalifa Road
MANAMA
Tel: 253297 Tlx: 8371

Belgium

Mecotronic sa/nv
Nieuwelaan 58
1860 MEISE
Tel: 02-269 07 48 Tlx: 65602
Fax: 2699455

Brazil

Sistronics Instrumentacao E Sistemas LTDA
Av Alfredo Agidio de Souza Aranha
75-4 Andar
Jd. Santo Antonio
0476 Sao Paulo, SP

COMECON Countries (D.D.R., Czechoslovakia, Bulgaria, Romania, Poland)

C.A.T. Electro Ltd.
20 Haymarket Terrace
EDINBURGH EH12 5JZ
SCOTLAND, UK
Tel: 031-3467050 Tlx: 727563
Fax: 031-3467065

Denmark
T.O. Elektronik
Ballerup Byveg 222
BALLERUP 2750
Tel: 42-658200 Tlx: 35293
Fax: 42-680300

Egypt
Etico Scientific
3 Ahmed Heshmat Street
P.O. Box 1653
Zamalek, CAIRO
Tel: 403041/407733 Tlx: 93382

Finland
Dualtek OY
P.O. Box 14
ESPOO 02321
Tel: 90-801991 Tlx: 123369
Fax: 90-8019911

France
Beckman Industrial Sarl
1Bis Ave du Coteau
93220 GAGNY
Tel: (01) 43027606 Tlx: 212971
Fax: (01) 43817252

Germany
Beckman Industrial Components GmbH
Frankfurter Ring 115
8000 MÜNCHEN 40
Tel: (089) 38870 Tlx: 5216197
Fax: (089) 3887238

Greece
Micronics Ltd.
46 Kritis Street
16451 Argyrouspolis, ATHENS
Tel: 01-9914786 Tlx: 216574

Hungary
Dahms Elektronik
Wienerstrasse 287
8051 GRAZ, Austria
Tel: 316-64030 Tlx: 31099
Fax: 316-6403029

Iceland
Karl Asgeirsson Rafeindataeknir
P.O. Box 406
121 REYKJAVIK
Tel: 1-622884 Tlx: 946240
Ref: 19023785

Iran
Zeefax Ltd., Zeefax House
320 King Street
LONDON W6 ORR, UK
Tel: 01-7487808 Tlx: 8813278
Fax: 01-7487188

Ireland
Neltronics Ltd.
John F. Kennedy Road
Naas Road
DUBLIN 12, EIRE
Tel: 503560 Tlx: 24837 Fax: 552789

Israel
Racom Electronics LTD.
P.O. Box 21120
TEL AVIV 61210
Tel: 03491922 Tlx: 33808
Fax: 03491576

Italy
Beckman Industrial Componenti Srl
Via Arese 11
20159 MILANO
Tel: (02) 6888951, Tlx: 330484
Fax: (02) 6896995

Jordan
Scientific & Medical
Supplies Co. P.O. Box 1387
AMMAN
Tel: 24902, Tlx: 21456

Kuwait
AZ Trading Co.
P.O. Box 25752
Jaber Al-Mubarak Street
SAFAT
Tel: 2442208, Tlx: 22707

Lebanon
Elco Ltd.
P.O. Box 136, ANTELIAS
Tel: 894420; 894699, Tlx: 22867

Malta
Fabian Enterprises
20, Msida Road, GZIRA
Tel: 513283, Tlx: 1837

Mexico
Dicopel SA
Francisco Pimentel 98
Col San Rafael
Delagacion Cuautemol
MEXICO 06470
Tel: 525-705-74-22
Fax: 525-703-17-72

Dinamica Inst. SA de CV
San Diego #25 Fracc Capistrano
54500 Aticapan de Zaragoza
edo de MEXICO
Tel: 361-39-12
Fax: 398-41-83

Morocco
Sicotel AS
Complexe Commercial Des Harbous
Tour C 3éme Etage, Ave Des Forces
Armées Royales, CASABLANCA 01
Tel: 010-212312270
Tlx: 27604M
Fax: 010-212316545

Netherlands
Diode B.V.
Meidoornkade 22, AE HOUTEN 3992
Tel: 3403-91234, Tlx: 47388
Fax: 3403-77904

Norway
Hellermann Haugerud A/S
Sandakerveien 110, 0483 OSLO 4
Tel: (02) 156012, Tlx: 18469
Fax: (02) 156129

Oman
Photocentre Comcent
P.O. Box 3115 (Ruwi)
MUSCAT
Tel: 773948 Tlx: 3499

Portugal
Decada, Equipamentos Electronicos Lda
Miraflores, Lote 102-B Alges
LISBOA 1495
Tel: 1410/34/20 Tlx: 15515
Fax: 14101844

Qatar
Qatar Trading Co.
P.O. Box 51, DOHA-QATAR
Tel: 323773 Tlx: 328642 Fax: 328642

Saudi Arabia
Mejdaf Establishment
P.O. Box 2002
RIYADH 11451
Tel: 4013206/4055240
Tlx: 202787

South Africa
Bowthorpe Hellermann Deutsch Ltd.
80 Mimetes Rd, Denver 2094
P.O. Box 27063, Benrose 2011
JOHANNESBURG
Tel: 11-6161960, Tlx: 4-28237
Fax: 11-6164715

Spain
Electronica Y Proyectos SA
Fernando Garrido 12
MADRID 28015
Tel: 341-4468141 Tlx: 42615
Fax: 341-4484750

Sweden
Q Instrument AB
P.O. Box 515, S-145
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